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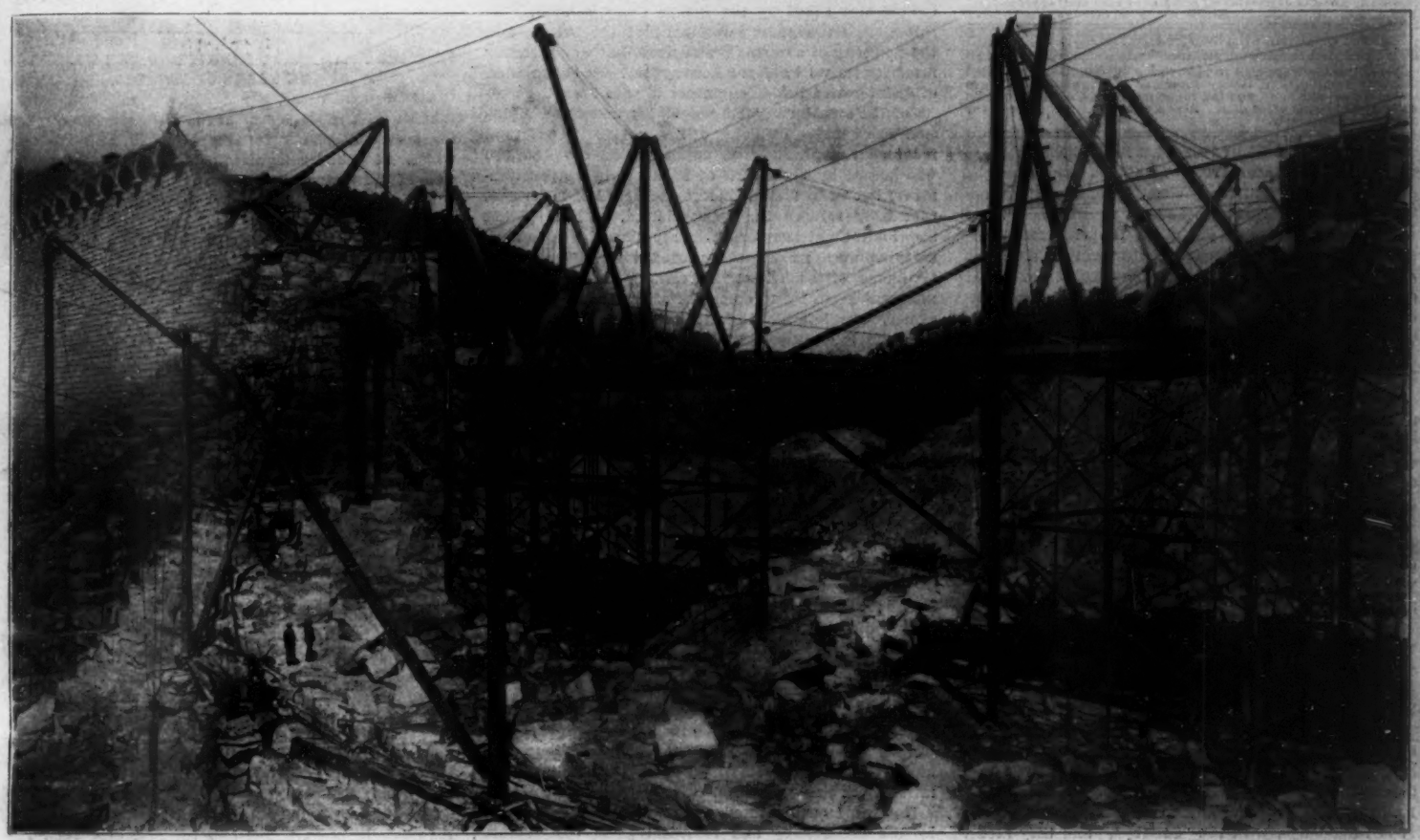
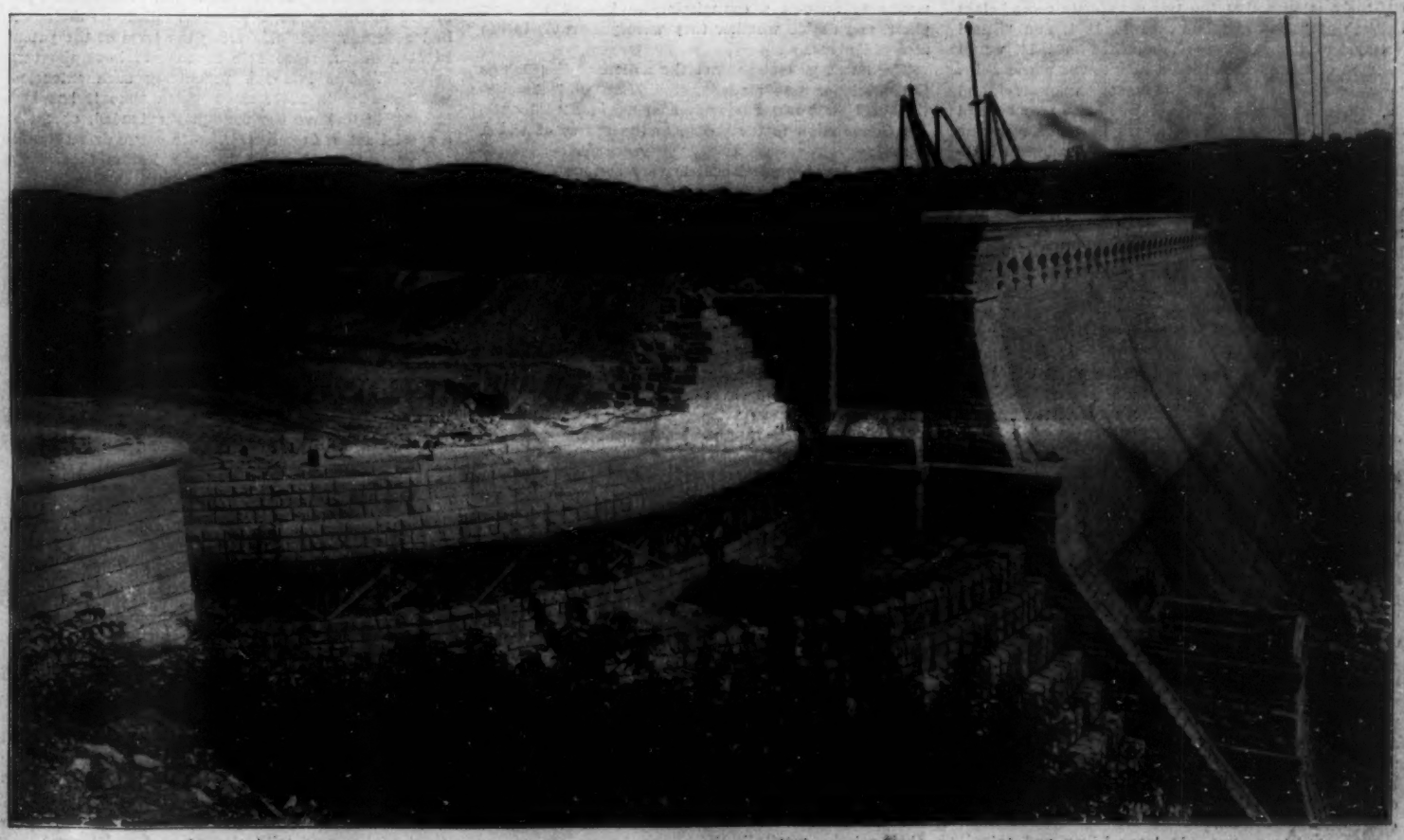


The portion of the dam here shown was originally to have been built of earth with a central core-wall. It is now for greater safety being built of masonry. The steel erecting towers are being built into the structure as it rises in height.



View Along the Crest of the Croton Masonry Dam, Showing the Spillway in the Foreground. Height of Crest of Dam Above Foundation, 297 Feet.

COMPLETING THE GREAT MASONRY DAM OF THE NEW CROTON RESERVOIR.—[See page 214.]

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NEW YORK, SATURDAY, SEPTEMBER 24, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE FORLORN HOPE OF THE BALTIC FLEET.

In view of the utter wreck of Russia's naval strength in the Far East, and the probability of the early capture of Port Arthur and blockade of Vladivostock, there was something almost pitiful in the elaborate ceremonies attending the recent departure of the Baltic fleet for the Orient. There can be no doubt about the official character of the dispatch of the fleet, for it was witnessed and sanctioned by the Emperor, attended by the High Admiral and other noted officers of the Russian navy. The Admiral commanding the fleet, with due ceremony, boarded the imperial yacht and bade his farewell to the Emperor. Then, with destroyers ahead and abeam, the "Kniaiz Suvaroff," one of the brand-new battleships, led the way down the Gulf of Finland to the tune of booming guns, the shouts of the populace upon the water fronts and piers, and the fluttering of many signal flags wishing good luck to the fleet on its long voyage.

In the press dispatches speaking of the event it was announced that the fleet would merely touch at Libau, where it would be joined by twelve transports, colliers, and supply ships, and that it would then proceed direct to the Orient. The fleet reached Libau. It is there at the present writing; and the latest dispatches have conveyed the inevitable tidings that for the present, it will remain there, its departure being dependent upon the development of events at the seat of war.

As for the fleet itself, it is certainly formidable, if only for the reason that it contains four new battleships, just completed, which are practically sister ships to the "Czarevitch," and, therefore, are to be reckoned as among the finest battleships afloat to-day. It is these ships, with the "Osliabya," and they alone, that could have any serious effect upon the issues of the naval campaign in the Far East; for the situation out there is such that the two out-of-date second-class battleships "Navarin," launched in 1891, and "Sissoi Veliky," of the same speed, launched in 1894, would be more of a hindrance than a help to the newer ships in any engagement against the seasoned, powerful, and victorious battleships of Japan. The same may be said of the odd assortment of cruisers that make up the balance of the fleet. There is the old "Admiral Nakhimoff," nineteen years old and good only for 17½ knots at her best, and the "Dmitri Donskoi," launched twenty-one years ago, and steaming well if she can make 15 knots an hour. These are armored cruisers; but the armor is of the old compound type, soft as butter to the high-velocity guns mounted by the modern Japanese armored cruisers. It is true there are three fast, unprotected cruisers, the "Oleg" and "Aurora," sisters respectively to the "Bogatyr" and "Pallada," and the "Almaz," sister to the "Novik;" but in the present stage of Russia's fortunes in the Far East, which can be retrieved only by the most desperate kind of fighting in line of battle, unprotected cruisers are merely "food for powder."

Let us suppose, however, that the Russians should have the fatuity to send this hastily-gotten-together and heterogeneous collection of ships out to the Far East, and that it should arrive there. Where would it rendezvous? Port Arthur would in all probability be in the hands of the enemy; while, if the siege were still in progress, the Russian fleet would have to fight its way through Admiral Togo's line of battle before it could gain the harbor—a line of battle composed of five of the most powerful battleships and eight of the best armored cruisers afloat; a fleet trained to the hour, manned by crews that are seasoned and expert, thoroughly familiar with their ships, knowing exactly what they can do. What the Russian fleet at Port Arthur, more powerful and fresh from its base, failed utterly to accomplish, will never be accomplished by a less powerful fleet that makes the same attempt at the end of a long and exceedingly trying voyage of several months' duration.

If the Baltic fleet should leave Libau and actually start for the Far East, it will mean, in the judgment of the naval experts of the world, that Russia, after losing the flower of her navy in the first campaign of the war, is merely sending the remnants to a similar and very certain fate. The damage already wrought by the prowess of Japanese arms has moved Russia down from third position among the navies of the world to fifth position. If the Baltic fleet should ever reach the Far East, the venture would in all probability end in Russia's losing what claims she now has to be reckoned a first-class naval power.

A GRAVE RESPONSIBILITY.

During the last administration the Municipal Art Commission of this city was called upon to pass upon a set of plans for a city bridge, to be known as the Manhattan Bridge, for which an appropriation of $7,600,000 was asked by the Bridge Commissioner.

Realizing the great importance of the bridge, and the necessity of securing a structure that was perfectly fitted for its work, Mayor Low appointed a commission of disinterested bridge engineers to pass upon the merits of the structure. This was done; and the commission of engineers, all being of international reputation, indorsed the plans. The appropriation of $7,600,000 was passed by the Board of Estimate and Apportionment; but when it came before the Board of Aldermen, that body refused the appropriation, without giving any logical reasons for their reprehensible action in delaying such an urgently-needed work. The expert testimony (if such it can be called) before the aldermen was given by an employee of the Bridge Commissioner, who left his desk to go to this meeting and condemn the plans of his superior, who, by the way, is recognized among engineers both in America and Europe as the leading authority on the design of long-span suspension bridges.

For this gross act of insubordination the employee was promptly and very properly discharged.

At the change of administration, the Commissioner was succeeded by a gentleman, who has not and does not profess to have any knowledge of bridge engineering, and he promptly installed the discharged employee in the responsible position of Chief Engineer of Bridges, a post which under the former administration was filled by the Commissioner himself.

The first act of the Commissioner and his new chief was to discard the plans, which, designed by the leading expert on such structures and indorsed by a disinterested commission of experts, had been passed by the Art Commission.

The next step was to draw up a preliminary sketch of a bridge costing $2,500,000 more than the discarded bridge, and taking one and a half years longer to build, and submit this raw proposal to the Art Commission for their approval.

It was at once pointed out to the Art Commission by the engineering and technical press that, before they passed upon these plans, they should, following the precedent set by Mayor Low, request the present mayor to appoint a commission to inspect the new plans, and decide whether they were preferable to the accepted plans.

The latest protest against the action of the Bridge Commissioner was made by the Merchants' Association of New York, during a hearing granted by the Art Commission to that body, in the course of which it said:

"There has been and still is very serious difference of opinion between the present Bridge Commissioner, unsupported by outside engineering ability, and the former Bridge Commissioner, supported by the findings of the expert commission to which his plans were submitted, as to the relative effectiveness, cost, and speed of construction under the respective plans.

"In view of these facts, the Merchants' Association, which does not pretend to any engineering knowledge and does not, therefore, favor one set of plans as against the other, most strongly urges upon your Commission that the approval by you of the plans prepared by the present Commissioner of Bridges be withheld until both sets of plans shall be submitted in detail, with specifications and strain sheets, to disinterested engineering experts of at least as high standing as those who passed upon Commissioner Lindenthal's plans. In this way the controversy as to the strength, cost, durability, and speed of construction of both plans would be decided by technical men of standing and reputation, whose decision would command the confidence of the whole community.

"Should your honorable Commission decide to approve Commissioner Best's plans without submitting them to expert engineers, the whole responsibility, both for the successful completion and operation of the bridge, and for any disaster which might occur thereon as a result of inherent engineering weakness, will rest upon your shoulders, because the approval of your Commission is necessary under the law before construction can commence. Your Commission, therefore, is the only body which can compel the submission of the plans to expert engineers for decision as to their relative merits."

In spite of the obvious contradiction involved in the repudiation by the Art Commission of properly-authenticated plans that they had already indorsed, in favor of imperfect plans lacking any engineering indorsement, the Art Commission has seen fit to accept the new plans.

We certainly agree with the Merchants' Association in the opinion that the Commission has assumed a grave responsibility in authorizing this important public work under circumstances that must be very discouraging to the friends of good government in the administration of city affairs.

For what good reason does the Art Commission, after accepting the findings of an expert investigation of a bridge designed by a competent engineer, now refuse to ask for a similar investigation of the undigested plans of a man who was a comparatively unknown subordinate in that engineer's office when those first plans were made?

PROPOSED AMENDMENT PERMITTING THE EXTENSION OF THE TERMS OF PATENTS.

At frequent times, we see many incidents which furnish the best evidences of the high esteem in which the inventors of our country are held, and the duty which the public recognizes of assisting in the perfection of our patent system, to enable inventors to secure the protection which, from the earliest days, our statesmen believed to be their due. It is deemed to be only just that an inventor who has added to the technical knowledge of the public, and has enabled the wants of the many to be better or more economically satisfied, should be suitably rewarded. In giving the inventor, for a time, a monopoly of the device, a knowledge of which he has furnished to the public, the reward is commensurate with the value of the knowledge furnished by the inventor, provided the term of the monopoly is reasonable.

In the several patent laws which have been enacted, the terms for which patents were granted have varied, and it has been evident that there is a difference of opinion on the question of the time during which the inventor should have the exclusive right to the patented invention; but on closer investigation, it will be found that this, in a measure, is because of the facts in particular cases. While, usually, the term of seventeen years, which is the period of the grant of a patent under our present law, is sufficient to recompense an inventor, and the difference in the returns will be in proportion to the value of the knowledge furnished to the public in the Letters Patent, it is found that, in particular cases, because of lack of capital, the necessity of using the invention in connection with another patented device the patentee of which will not make reasonable terms, the difficulty in procuring raw material, or other causes, inventors have been unable to receive the expected return, and that in those cases, to do justice it is necessary to extend the otherwise definite term in which they may reap their reward.

Earlier enacted patent laws of the United States permitted patentees who, through no failure on their part, had been unsuccessful, during the term of the patent, in obtaining a reasonable reward, to have the term extended. The last law permitting such extensions was repealed in 1861, since which time it has been impossible to have the monopoly extended, except by a special act of Congress. The injustice arising under the present law has led to an agitation to create a sentiment in favor of an amendment which will reenact provisions of the law enabling inventors in special cases to have the life of their patents prolonged. The members of the American Bar Association have been communicated with concerning the proposed amendment, and they appear to be unanimously in favor of the change in the law. The question is now being submitted to the patent solicitors and specialists of the United States, and at the meeting of the American Bar Association, to be held shortly at St. Louis, a resolution in favor of the change in the law will be submitted for the vote of the members present. Considering the replies which were received to the letters previously addressed to them, the vote of the members of the American Bar Association will undoubtedly be favorable to the proposed amendment.

As the members of Congress, who have been interviewed concerning the proposed change in the law, seem to be decidedly in favor of extending the privileges granted to inventors, it is likely that the amendment will, at the next session of Congress, be enacted.

TRUNK LINES AND TROLLEYS IN THE EAST.

The announcement that the New Haven road will spend $8,000,000 for the improvement of its suburban service near New York is of special interest to electricians, for of the six tracks entering the city limits four will be of the third-rail electric type, two for local trains, and two for express trains to run under a fifteen-minute headway. The land for the new tracks has been secured, but plans are not completed either for the installation of the electric lines or for the equipment of the road with electric cars and locomotives. However, the general plan will be to connect local electric trains with the underground electric road of the

new city subway, and to give commuters thereby a convenient method of traveling from the business section of the city to their suburban homes.

This completely revolutionizing scheme of one of the oldest roads in the East, taken in connection with the installation of the Fourth Avenue tunnel with electricity by the New York Central, indicates pretty clearly that the trunk lines in the East are entering the electrical railroad field in order to save their traffic from complete demoralization by the trolleys. The struggle between the two systems of transportation, steam and electricity, is thus likely to terminate in the general adoption of the latter for nearly all work except possibly the long-distance through express service. Eventually this may also be changed to follow in the line of progress; but at present it is impossible to predict its future.

In New England the trolleys have intersected the country so that passengers can go from one town to another without once riding on the steam roads, and in most cases the two lines run parallel. The trolleys in nearly all such instances have robbed the steam roads of their local, short-distance traffic. The latter tried the expedient at first of reducing fares to compete with the trolleys, but this proved of little avail, for the trolleys were more convenient and satisfactory for a ride of five or ten miles than the steam cars. The time table of the latter would have to be revised so that trains would have to run every five or ten minutes to hold this local, short-distance traffic.

The changed attitude of the steam roads indicates now that they will enter extensively into the work of building trolley roads as feeders to their main lines. Towns and cities a few miles back from the steam roads are being connected rapidly by short trolley roads built and operated by the steam roads. These trolleys run to meet all trains, and passengers thus find it convenient for them to connect with trains at the least possible expense and trouble. Formerly only stages connected these towns with the steam roads, and their isolated positions inland retarded their growth tremendously.

The effect of this enlightened system has already been noticeable. Towns and villages that possessed unusual natural surroundings, but owing to their location inland were out of touch with the rest of the world, have suddenly increased in population and business enterprise. Some of them have actually doubled in population within three years owing to their direct connection with the steam roads by trolley feeders. Summer visitors have flocked there, so that their former stagnant life has been completely revolutionized.

It is apparent that most of the eastern roads have within the current year reached the conclusion that they must wake up and adopt new policies. They cannot run counter to public demands much longer when the latter have the electric roads to use as a final weapon to force them to compliance. The New York Central and the New Haven roads have both entered extensively in the electrical field all along their extensive routes. In some instances they have bought up the different trolley systems, or secured control of them so they would no longer compete with the steam roads, but act as feeders to them.

Several of the eastern railroads have gone far in the past few months in building feeders to their lines, and incidentally forestalling private trolley companies in constructing new systems in localities where the traffic is now small. The question of establishing motor cars as feeders has been tried in England by the Great Western Company, and the same subject has been brought up here for consideration. In parts of the country where no trolley roads are to-day built, the motor cars might connect small hamlets with large towns on the line of the railroad, and thus promote better traffic. The English motor cars used for this service between the Lizard and Helston station, in Cornwall, accommodate 32 passengers, and since they have been in operation they have proved profitable. A similar service was tried this summer at several of the beaches by the New Haven road. The beaches had natural advantages that should make them popular, but no company had yet built trolleys running to them. It is doubtful if the summer traffic would be sufficient to make a trolley line profitable for the whole year, for the travel is confined chiefly to the three or four summer months.

The New Haven road started a line of motor cars from the nearest station to the beaches, connecting with the principal trains running to the cities. The result has been that the traffic to the beaches more than doubled this year, and at the present rate of increase the summer population should almost warrant the building of a trolley line within another year or two. The success of such summer motor cars as feeders to the main railroad lines has the further advantage of opening up new territory and laying the foundations for future trolleys. It is possible to ascertain the relative value and possibilities of a new route by installing such a motor car line. If the natural advantages of the place are sufficient to attract summer visitors when a good service is provided, the projection of a trolley line is merely a matter of a year or two. Next summer the New Haven road promises to develop many new beaches and isolated routes by this method, and if the traffic increases, trolley lines under the steam road's control will follow.

Even the question of the trackless trolley has received consideration in the past. Awakened from their long sleep, the railroads are looking around for every possible improvement and development that will place them abreast of the times. Having adopted electricity as an auxiliary motive power, it is only natural that they should seek to utilize it whenever possible.

The trackless trolley has been tried in Germany, but whether the greater cost of operating the cars over dirt or macadamized roads instead of on rails will not more than offset the expense of building tracks is a question that cannot be answered. There are, however, companies who believe otherwise. Within the past month two or three independent companies have been organized for experimenting with the trackless trolley. The application for a charter to use the turnpike for such a trackless trolley was denied the past month in New Jersey because there was no existing law which could control the operation of the cars. It was the legal opinion that the trackless trolley was neither a railroad, nor yet a vehicle in the ordinary sense of the word. Consequently until some new law was passed to control the trackless trolley, it would be wise to refuse to issue a charter for using the right of way of a public road. However, this short-sighted legal view of the matter will not be final if the trackless trolley can be proved to be of value in the development of the country.

Unquestionably the trackless trolley should prove an effectual feeder to the railroads in many parts of the country where small towns and villages are located off from the main lines of traffic, provided the cost of operation is low enough to justify this method of propulsion. The roads must be firm and smooth the greater part of the year to make the service of any value, and as a result they must be macadamized or securely built so that the drainage is perfect. Muddy winter roads would put the trackless trolley out of service about as quickly as anything. The snow problem would have to be considered also, for while it might be easy to clean the tracks of snow, sleet, and ice, it is quite another proposition to keep the whole side of a turnpike free of obstacles. There would also arise many problems regarding the right of way. Not every teamster or driver of an automobile would yield to the trackless trolley car the best part of the road, and trouble and confusion, with resultant litigation of a costly nature, might follow to involve the company.

However much these side issues of the general movement of the steam roads to adopt electricity may seem exaggerated and uncertain in their ultimate good, it cannot be denied that the old struggle between the trolley and steam railroad in the East is entering upon its final stage, which is nothing less than the capitulation of steam and electricity. The latter has proved too formidable for the former, and it is rapidly being adopted by the most conservative of steam railroad corporations, not simply for city tunnels and bridges, but for suburban traffic, country short-haul feeders, and even for express service in certain sections.

THE NEW YORK SESSIONS OF THE EIGHTH INTERNATIONAL GEOGRAPHIC CONGRESS.

The Eighth International Geographic Congress began its first convention in the United States at Washington, September 8, and continued it at Philadelphia, New York, Niagara Falls, Chicago, and St. Louis during the succeeding fortnight, under the presidency of Commander Robert E. Peary, U. S. N. The honorary presidency of the congress was held by President Theodore Roosevelt.

In New York the congress was the guest of the American Geographical Society, and the sessions were held at the house of the society in West 81st Street and in the halls of the American Museum of Natural History on Tuesday and Wednesday, September 13 and 14, while Thursday, the 15th, was devoted to an excursion up the Hudson to Mount Beacon and to West Point, closing the sessions in this city.

The days were devoted to the scientific programme, in which many papers of interest and value were presented, and of which an extended report will soon appear in the SCIENTIFIC AMERICAN SUPPLEMENT. The convention here began with a general session Tuesday morning in the lecture hall of the American Geographical Society, at which Commander Peary gave the visiting geographers, who numbered some 300, a cordial welcome to the city, and then introduced the general programme, which for the morning consisted of addresses on Deep Sea Deposits, by Sir John Murray; on the Volcanoes of Martinique, Guadeloupe, and Saba, by Dr. E. O. Hovey; and on the Rise and Development of the German Colonial Possessions, by Graf Joachim von Pfeil.

The sectional meetings began in the afternoon, and at these the numerous papers of the convention were read in full or by title. The sections meeting here and their officers were: Oceanography, William Libbey chairman, R. A. Harris secretary; Exploration, H. G. Bryant chairman, H. L. Bridgman secretary; Economic Geography, E. R. Johnson chairman, C. W. Hall secretary; Educational Geography, Charles R. Dryer chairman, E. C. Jones secretary; Volcanoes and Earthquakes, Charles H. Hitchcock chairman, E. O. Hovey secretary.

Tuesday evening a public lecture complimentary to the congress and the society was given in the auditorium of the museum by Dr. and Mrs. W. H. Workman on their recent high ascents among the Himalayas and the glaciers of those mountains. Dr. Workman has established the record for high altitude on land, attaining an elevation of 23,397 feet, and Mrs. Workman's record is only two thousand feet less. A brilliant reception at the house of the society followed the lecture.

The dinner of the congress was held Wednesday evening at the Endicott Hotel. This was complimentary to the foreign delegates, and was largely attended. In the course of the dinner Commander Peary announced that his plans for another attempt at the North Pole had gone so far that the keel of his new ship had been laid, and that she would be ready for use next summer. She is to be a vessel of the strongest construction, adapted particularly to the work in view, and provided with engines capable of exerting 1,500 horse-power. A feature of the evening was the presentation to Commander Peary of the gold medal awarded to him by the Paris Geographical Society for his Arctic researches.

Among the celebrities present may be mentioned Sir John Murray, of the Scottish Geographical Society; Prof. A. Penck, of Vienna; Dr. H. R. Mill, of London; Graf Joachim von Pfeil, of Berlin; Major A. St. H. Gibbon, of London; Profs. H. Cordier and G. Grandidier, of Paris; M. de Claparède, of Geneva; Dr. Bela Erödi, of Buda-Pest; Prof. A. Marcure, of Berlin; Prof. Oberhummer, of Vienna; and Prof. J. Thoulet, of Nancy. About 120 foreign delegates were in attendance, and the total registration was about 800. The next convention of the congress, five years hence, will be held in Geneva, Switzerland.

SCIENCE NOTES.

Prof. Constantine Gregory, of Naples, has invented a new chemical process for the preservation of flowers and foliage. When the professor submitted the results of his first experiments to the Neapolitan Institute for the Advancement of Science, a few weeks ago, the association, after carefully examining them, requested the preservation of some plants which they described, and which in their opinion presented the greatest difficulties owing to their peculiar nature. The professor completed the trial set before him, and he has presented some splendid examples of begonia and orchid leaves which have a remarkable natural appearance. In recognition of this work he has been awarded the silver medal of the institute. The professor is now engaged upon the extension of his invention to fungi, and in the event of his achieving success he will be presented with the society's gold medal.

In a recent number of La Energía Eléctrica, A. Sandaran describes a new method of testing the molecular state of locomotive axles and other iron and steel pieces, this method being based on the magnetical properties of iron and steel, and intended to reveal any injury these pieces possibly have undergone in operation. From the principles of magnetism, it is inferred that when testing an iron or steel piece before commencing work, the graphical representation of a magnetizing cycle will afford an illustration of the magnetical properties of the piece concerned. Now the axles of locomotive and railway carriages, as well as other machine pieces, are exposed in operation to such vibrations and shocks as to become brittle, when the fracture will show a crystalline structure. At the same time the magnetical residual phenomena are diminished, the iron piece assuming the normal average state as corresponding with the magnetic force, its hysteresis being diminished and the ascending and descending branches of the induction curve differing from each other to no material degree. Between the magnetizing curves of an axle or another iron piece as recorded at different periods of operation there may thus be noted important differences, a magnetical investigation of the piece in question allowing of conclusions being made as to its present safety, and of stating whether any abnormal alteration such as an internal fracture has occurred.

The last 100-foot crib, which forms the foundation of the new government breakwater at South Chicago, was recently put in place and sunk by the contractors. The pier when completed will extend 6,900 feet from the shore of the north side of the Calumet River, and form a complete protection from north and northeast storms.

THE MANUFACTURE OF WALL PAPER.

BY W. FRANK M'CLURE.

The interesting industry of wall-paper making begins with the drawing and hand coloring of the multitudinous designs which are to decorate the walls of American homes. This is followed by the transferring of these designs by pattern makers to wooden rollers, then the skillful mixing of the paint, the applying of the background to the rough paper, and subsequently the printing of the colors by machinery. The rough paper from the pulp mills comes in huge rolls not unlike those used in the office of a metropolitan newspaper. Much of the clay used in mixing the paints is brought from Georgia.

The wall paper designers are already at work upon the designs of 1906. The styles in wall paper change every season, and the designers work a year and a half and sometimes two years in advance. The designing room is to the majority of visitors to a wall paper factory the most interesting department of all. It is here that the pattern makers are at work, reproducing with brass and felt the designs upon the hard maple rollers. When the designs have been sketched and painted by hand, they very closely resemble the finished wall paper product. Into the wood of the rollers a thin brass tape is driven. This brass tape can, of course, be easily shaped to follow the pattern. The felt is packed within the space which the brass tape encircles. When the patterns have been completed, they are all properly numbered and go to a pattern block room. There are three distinct sets of these rollers necessary in the making of a complete pattern for a room—one set for the sidewall, one for the border, and one for the ceiling. The cost of making a new pattern is often more than $500. A large factory usually carries at least one hundred complete room patterns, which with the different combinations of color admits of many hundreds of variations in the finished product. One of the accompanying photographs clearly illustrates a pattern block room.

The making of the paints which are to decorate the wall paper is one of the most important branches of the work, for very much of the completed appearance of the paper depends upon the skill with which the tints are mixed and in keeping the mixture uniform throughout the printing of the different patterns. The white clay which forms a most necessary portion of the tinting mixtures is first ground to a powder. The clay is used chiefly in the paints for backgrounds, and in this mixture boiled glue is used as a sizing. In the making of tints for the subsequent decorations, oxide of zinc is extensively used, with potato dextrine for sizing.

Before going to the giant presses for the great mechanical operation of printing numerous colors at one time, the background must be applied by the brushes of a large mechanical device, through which the white paper passes as it comes from the huge rolls, each one of which, by the way, contains sufficient paper for 200 or 300 finished rolls. As the paper leaves this machine it is carried for some distance on racks, which allow it to hang in folds. Beneath its path on this trip are steam pipes, which together with the hot air that is blown into the folds, serve to dry the coating of paint which has just been applied. The paper is next returned over the same route by the aid of a cloth web, and goes at once into the color-printing machines.

The large cylinder of the printing machine receives the paper, and it is soon brought in contact with the various rollers or pattern blocks, each color being applied by a separate roller, which of course revolves in accurate register upon the paper. The paper passes through the machine but once, receiving at this one run any number of colors up to twelve. As the decorated paper comes from this machine, it is again carried in festoons or folds over steam pipes, after which it is reeled into bundles of 200 rolls each. By the register on each printing machine it is possible to ascertain at any time just how many rolls of paper have been printed of a desired pattern. Finally the bundles are unrolled and made into lengths of sixteen yards each, which is equivalent to a double roll of paper. Usually a force of girls is employed in winding the double roll lengths upon spindles, twenty-five of which lengths go to make a bundle, which when tied is ready for shipment. In cutting the long rolls into pieces, each 16-yard length is determined by a mark automatically placed upon the roll while it is passing through the printing press.

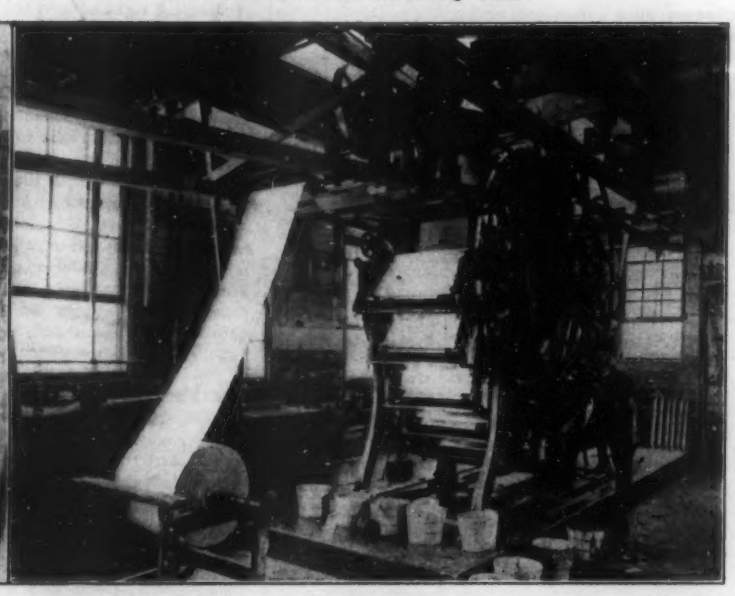
Large wall-paper factories operate from ten to twenty printing presses, each having a daily output of some twenty miles of wall paper. The annual output of an entire factory sometimes exceeds 25,000,000 rolls.

The prices of wall paper vary from a few cents up to dollars per roll. Few families nowadays are so poor but their homes may be rejuvenated from time to time with pretty wall paper. The cost is not dependent upon the number of colors which have been applied to the paper, but more upon the quality of the paper used. The demand for wall paper in this country is increasing with each year.

Where the Pattern Blocks Are Kept.

A Corner of the Paint-Mixing Room.

Designers at Work Making Patterns of Wall Paper to be Used Two Years Hence.



This Machine Applies Twelve Different Colors at One Time to a Roll of Wall Paper.

THE MANUFACTURE OF WALL PAPER.

M. Max. Wolf, in the Bulletin of the Société Astronomique de France, treats of the observation of nebulæ, and states that the study of nebulæ of great extent, like that of Orion, has become much easier since the use of objectives of short focus for star-photography. In the course of his observations he brings out the remarkable fact that the great nebulæ are always surrounded by spaces which are nearly empty and thus form a veritable stellar desert, as was already pointed out by Herschel. But M. Wolf finds that the empty space lies on only one side of the nebula, and in this space the stars of low magnitude are entirely wanting. Only a few rare and brilliant stars are to be found. It seems that the nebula has grouped all the smaller stars around its center. He cites a number of the great nebulæ which verify this law. But the nebula of Andromeda and the spiral nebulæ do not follow the same order, and apparently should be placed in a different category.

A REASONING HORSE.

Hardly a day passes but the newspapers have something to say of the wonderful mental performances of "clever Hans," "*der kluge Hans*," as Herr Von Osten's stallion is called. Indeed, some wordy controversies have been waged over him. Some hold that he actually reasons; others skeptically assert that his intelligence is simply the result of ingeniously concealed trickery on the part of his trainers. An investigation conducted by scientists, however, would seem to indicate that the horse is really what his owner claims him to be, an intelligent four-footed animal, capable of making simple arithmetical calculations, and even of ratiocination. Dr. Heinroth, of the Berlin Zoological Garden, has this to say of Hans' wonderful feats in a recent number of the Illustrirte Zeitung:

"For many years Herr Von Osten, who was at one time a tutor of mathematics, has made it his task to determine the intellectual possibilities of a horse. His first stallion, with whom he succeeded in doing remarkable things, died at the end of eight years. Hans, his second acquisition, has been under his care for four years. Von Osten has no desire to sell the horse or to display him for money in public. He is instructing him in the interest of science alone.

"In my presence Von Osten asked the horse to add such sums as 6 + 2 and 4 + 3. The horse indicated the correct answers by stamping with his right fore-hoof. It is to be remarked that during the calculations Von Osten feeds Hans with carrots. Von Osten declares that without the carrots the horse would refuse to work. Hans has never felt the touch of a whip. This, after all, is not very strange; for, as Von Osten puts it, carrots are to Hans simply what honors, titles, rank, and money are to men.

"I asked 'What are the multiples of 12?' The answer came almost immediately. Sums such as 72 + 14 are correctly given. The actual words (in German) 'What is the difference between 43 and 67' were read, and the answer immediately pawed. No numerals appeared on the blackboard. Surely, this is more than the trickery of training. It should here be mentioned that questions can be put by any bystander. Hans is able to convert common fractions into decimal fractions. He can also tell time by the clock. If he is asked, 'It is now 40 minutes after 12; how many minutes will elapse before one o'clock?' he immediately answers with twenty strokes of his hoof. These are simply a few among a great number of questions that were put.

"Hans knows the coin of the realm and the value of playing cards. King, queen, ace, and the like are differentiated by the hoof. He picked out a badly-worn German 50-pfennig piece from several coins. From a number of pieces of colored cloth laid upon the ground he will select any color he is ordered to choose. 'Is it green?' you ask. Five strokes of the hoof is the reply; and the fifth cloth proves to be green. The colors may be changed in any manner; still the horse will pick out the correct one."

Dr. Heinroth concludes his article by stating that he is quite convinced of the impossibility of any deception. He has questioned the horse in his stall in the absence of its owner, and he has received answers as clear cut and as precise as those given in the presence of Von Osten.

The Reasoning Horse "Hans" and His Owner.

"Hans" Answering an Arithmetical Question by Pawing With His Hoof.

Some figures have been published on the production and commerce of quinine. According to the report of the chief of the government plantations in British India, the Madras government produced 15,711 pounds of quinine in 1902, and the Bengal government 11,927, making a total of 27,638 for India. Java produced and exported 43,750 pounds. As to the exportation of bark for 1902, Java heads the list with 14,726,000 pounds, followed by India with 2,020,000, Ceylon with 407,000, South America 775,000, and Africa 180,000, making a total of 18,108,000 pounds. This represents the bark which has been supplied to the trade, and it is estimated to contain 861,810 pounds of quinine. Adding these figures to the above-mentioned quantity produced in India and Java, we have a total of 933,200 pounds, which represents the total amount of quinine produced in 1902. As to the quinine-producing establishments, there are 5 in France, 3 in England, 2 each in Germany and Italy, one each in Holland, Java, Bengal, and Madras, besides those in America. The two leading markets are Amsterdam and London, but the latter has become less important since the development of the Java production.

WHEN WAS THE PHOTOGRAPH TAKEN?

BY PROF. WILLIAM F. RIGGE.

I wonder what the reader will say when I show him this photograph of the Creighton University Observatory [at Omaha, Neb.] and ask him to tell me when the photograph was taken. I will allow him every liberty but one—he must not ask the photographer.

The condition is rather severe, but not worse than my own, because I do not know the photographer, nor could I after diligent inquiry find anyone who knew anything at all about the picture.

I am very fond of mathematics. It seems to run in my blood. I looked upon this picture for years, and was convinced that the shadows in it had automatically and unmistakably stamped the date and time of its taking upon the photograph. I investigated, I measured, I computed. And now I know when the photograph was taken. If the reader is willing, I will take him into my confidence, and show him how the problem was solved. I will investigate three things: 1, whether it is possible in principle to obtain the date of a photograph from the shadows in it; 2, whether it is possible in practice; and 3, how closely our results are to be trusted.

The direction in which the shadow of an object is cast evidently depends upon the sun's position in the sky, and ought therefore to serve as a means to obtain this position. Now, the twofold motion of the sun is causing it continually to change its position: the diurnal motion is carrying it about in a circle whose center is at the celestial pole, the annual one is carrying it toward or away from the celestial equator. As these two motions are independent of one another, every determination of the sun's position by means of a shadow it casts ought to give us its place in both of these orbits, that is, give us the time of the day and the day of the year. Fig. 2 will show us how this is done.

Let us imagine the heavy line *AB* to be the shadow cast upon a horizontal surface by the vertical rod *OB*. With the radius *AO* let us describe a miniature celestial sphere about the point *A* as a center. Let *NESW* be the great circle of the horizon with its cardinal points, and *NPZS* that of the meridian. *Z*, vertically over *A*, will be the zenith, *O* will be the sun's position, and *P*, so taken that the angle *NAP* is equal to the latitude of the place, will be the celestial pole. The points *Z*, *P*, *O*—zenith, pole, sun—are the vertices of the great astronomical triangle with which we must become acquainted. The side *PZ* is the complement of the arc *NP*, which is equal to the latitude of the place. The side *PO* is the sun's polar distance, and is the complement of its declination, or of its distance from the celestial equator. The side *ZO* is the sun's zenith distance and the complement of its altitude *OH* or of the angle *OAH*. The angle at the pole, *ZPO*, is called the sun's hour angle, and is proportionate to the time elapsed since the sun crossed the meridian. The angle at *Z*, *PZO*, or its equal *NAH*, is the sun's azimuth, or bearing, as a surveyor would call it, reckoned from the north point of the horizon. The angle at *O*, *POZ*, is called the parallactic angle. We have no need of it in our discussion. In this triangle the hour angle *ZPO* determines the sun's position in its diurnal orbit and gives us the time of day; the side *PO*, the complement of the sun's declination, determines the sun's position in its annual orbit and gives us the day of the year. The measurement of the shadow *AB* of the rod *OB* must, therefore, in some way give us the angle *ZPO* and the side *PO*. It does so indirectly. Spherical trigonometry teaches us that if any three of the six parts (three sides and three an-

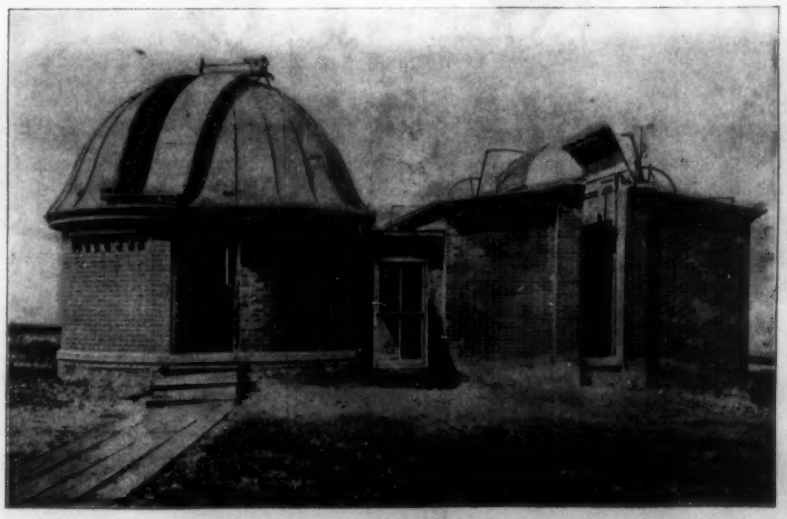


Fig. 1.—WHEN WAS THIS PICTURE TAKEN?

gles) of a triangle are given, the other three are thereby implicitly and definitely determined and can be found by computation. Now we have three such parts given in the triangle *PZO*. The first is the side *PZ*, the complement of the latitude of the place where the shadow is cast. The second is the angle *PZO*, the sun's north azimuth, the supplement of its south azimuth *OZS* or *HAS* or *BAD*. This latter angle *BAD* is determined in the right plane triangle *BAD* by the sides *BD* and *AD* (or *CB*), the distances which the shadow falls east [or west] and north [or south]. And finally the third part is the side *ZO*, the complement of *OH*, or of the angle *OAH* or *OAB* the sun's altitude, this latter angle being found in the right plane triangle *OAB* by the sides *OB* and *AB*. Hence a measurement of the position of a shadow with respect to the object that casts it, that is, of the distances *BD*, east or west, *BC*, north or south, and *BO*, downward, or of its three space co-ordinates, as a mathematician would name them, will furnish us with all the data necessary and will determine the day of the year no less than the time of the day when the shadow occupied that particular position. It is evident that the object casting the shadow need not be a vertical rod, nor that the shadow should fall upon a horizontal plane. All we need absolutely is the direction in space of the line joining the shadow and the object, that is, technically, its altitude and azimuth, these data being best determined in practice by means of the three space co-ordinates, measured by a plumbline, level, compass, tape line, or similar instruments.

We come now to the second and practical part of the problem, the actual measurement of the three co-ordinates, *BD*, *BC*, and *BO*. And here we are at once confronted by two difficulties. The first and greatest of these lies in the identification, or rather in the determination of the exact location of the shadow of a known point upon a photograph. In our reproduction of the photograph of the Creighton Observatory it will be seen that the stone coping on the west side of the meridian slit in the transit room casts its shadow very conspicuously on the window casing. The shadow falls exactly upon the middle of the flat western side of the casing and on a level with the mortar line between the tenth and eleventh bricks below the coping stone. This casing is in reality two and a half inches wide, but upon the original photograph it is only 12 thousandths of an inch. An error of one thousandth of an inch in the localization of the shadow upon the photograph would make the result uncertain by a day. The second difficulty is a minor one, and lies in the practical measurement of the three co-ordinates. This measurement is, of course, executed upon the object itself from the information obtained from the photograph. It was found that the shadow fell 31.35 inches downward, 27.70 inches eastward, and 12.25 inches northward. These data coupled with the latitude of the place, 41 deg. 16 min. 6 sec., tell us by computation that the sun's declination was 15 deg. 15 min. north and the hour angle 41 deg. 12 min. or 2 hours 45 minutes afternoon, local apparent solar time. Reference to any large and good celestial or terrestrial globe, to the Nautical Almanac, or to similar sources, shows that the sun has the declination +15 deg. 15 min. on May 2 and August 11, that is on two dates, at one of which the sun is going north and at the other going south. In order to determine which of these two dates is the correct one, we must resort to evidence other than that furnished by shadows. In our case we see upon a close examination of the original photograph, that the condition of the grass in the foreground and of the trees in the background is such as to point unmistakably to the earlier date, that is, to May 2. Now, as the sun is 3 minutes fast on May 2, and as Omaha clocks are set 24 minutes fast in order to show central time, this gives us May 2, 3.06 P. M., central standard time, as the date and time when the photograph was taken.

In order to confirm our result, let us turn to Fig. 3, which represents a part of the window casing drawn to actual size, two and a half inches wide. The line *AB* is on a level with the mortar line between the tenth and eleventh bricks, and *DE* and *FG* are on a level with the next mortar lines above and below *AB*.

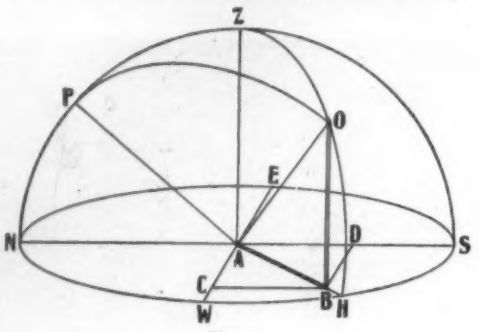


Fig. 2.

C is the location of the shadow, as shown on the photograph. The long oblique line passing through *C* shows the path of the shadow on the casing on May 2 and August 11, and the position of the shadow at in-

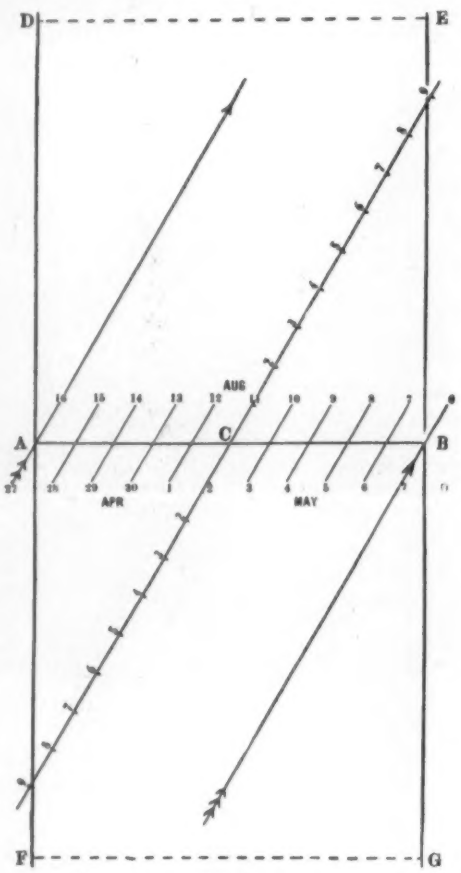


Fig. 3.

tervals of one minute before and after its passage through the critical point *C*. The other two long oblique lines show the path of the shadow five days before and after, and the short lines show it for every day. After making due allowance for the practical difficulties of the problem, is it claiming too much to assert that in this case the date is correct within two or three days, and the time within as many minutes? If the shadow had fallen as many feet as it did inches away from its object, would not the very day and the minute be fixed? I dare say, however, that in spite of all this evidence most of my readers would rely more upon the word of the photographer or upon actual observation than upon all the mathematics in the world. To quiet their apprehensions, let me say that on last May 2 (1904) at 3.06 P. M., central time, the shadow was at the place assigned as accurately as anybody could desire. I will also add that I had finished the computation, and proposed the problem to my students two months before.

"Oh! but you are forgetting a most essential item, the year!" the reader may exclaim.

A half-tone of this photograph of the Observatory appeared in the Creighton University catalogue in June, 1894, hence it must have been taken at the latest in May of that year. As it was evidently taken in the sunlight, perhaps the weather conditions may decide the year. The cumulus clouds in the sky, the northwest wind indicated by the weather vane, and the transparency of the air, which on the original photograph allows trees about three miles away and bluffs about six miles away to be seen with great distinctness, show that there must have been a rain a short time before to clear the atmosphere, the wind must have continued to blow from the northwest for many hours, and the barometer must have been high. Prof. L. A. Welsh, our local weather forecaster, has very kindly examined his records and they, together with those kept at our Observatory, prove beyond the possibility of a doubt that May 2, 1893, is the day we are looking for. Not only do the weather conditions shown on the photograph apply to that date in all their completeness, but they also single it out most emphatically from the preceding and following days of that year. And more than that, they also determine the year, because they cannot be made to apply to May 2 or contiguous days in 1894, 1892, 1891, and 1890, and further back than that I need not go for reasons that would not interest the reader.

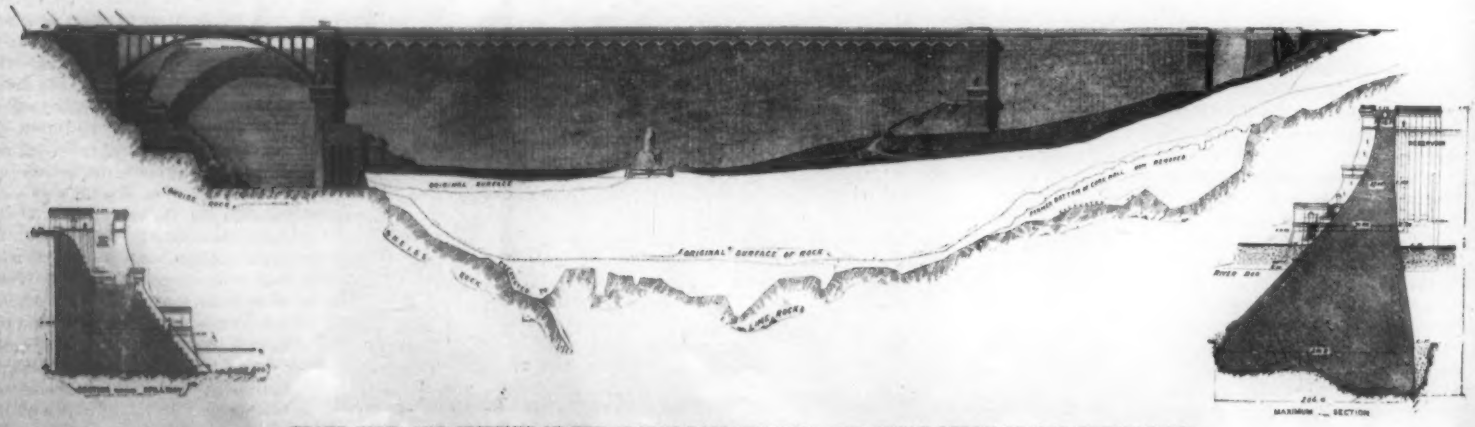
If, therefore, I am asked when this photograph of the Creighton University Observatory was taken, I can answer with an assurance and an accuracy superior to that of the photographer himself if he could now be found and interrogated: Tuesday, May 2, 1893, at 3.06 P. M.

Creighton University Observatory, Omaha, Neb.

COMPLETING THE NEW CROTON DAM.

For the first time in all the many years that it has been under construction, work at the great Croton dam is proceeding with positive energy. The activity is due to a desire to finish the gap in the southern end of the dam, where recent alterations in the plans have seriously delayed the work. In explanation of the delay it will be well to briefly recite the facts.

As originally designed, the Croton dam was to have consisted of a solid masonry structure for about two-thirds of its length and of an earth dam with a center core wall for the remaining third. This core wall was to consist merely of a thin masonry diaphragm impervious to the water, which was intended to seal the earth dam against the passage of any water. The substitution of earth for masonry was made by the then chief engineer, chiefly from considerations of economy. On the accession of the late chief engineer, Mr. Hill, to office, he at once condemned the composite nature of the structure, and recommended that the masonry work should be carried continuously across the valley, providing a homogeneous structure. In support of this recommendation he pointed out that there were strong engineering reasons against the use of the earth and core wall construction, especially in connection with an all-masonry structure. After a board of experts had indorsed his criticisms, the core wall as far as it had been built was taken down, and it was then discovered that the bottom on which it rested was of a treacherous and more or less friable material, which in the presence of water seemed to lose its consistency entirely. Accordingly it was decided to carry down the excavation until absolutely sound rock was reached.



FRONT VIEW AND SECTIONS OF THE CROTON DAM, SHOWING THE GREAT DEPTH OF THE FOUNDATIONS.

The accompanying engraving shows the great dam as it will appear when completed, if viewed from down stream. The length of the dam proper from the right abutment to the commencement of the spillway is 1,168 feet. This portion as now being constructed will be one continuous solid wall of first-class masonry laid up in cement, and everywhere carried down to solid rock. The illustration referred to shows the actual depth to which this excavation had to be carried. It will be noticed that on the left side of the valley the engineers encountered a solid and very satisfactory gneiss rock, which extends for more than a third of the distance across the valley. Then the sub-stratum consists of a lime rock not so satisfactory as the gneiss, but still sufficiently stable for a good foundation when excavated to the great depths shown in our engraving. The deep places in the foundation are due to the discovery of pockets of rotten rock which had to be excavated. The lowest point of foundation is 131 feet below the bed of the river. The top of the dam is 166 feet above the bed of the river, thus giving a total height of the masonry from foundation to crest of 297 feet. At the top the wall has a thickness of 18 feet, and it increases in thickness proportionately to the hydraulic thrust against it. This increase extends not merely to the bed of the river or bottom of the reservoir, but more than as far again below it, until the foundation is reached. Since the overlying material between the bottom of the reservoir and the bottom of the foundation will be saturated with water, the masonry dam has to be treated as though it had a head of water against it for practically its whole height of nearly 300 feet. Consequently, to secure sufficient weight and stability, the width of the dam at the lowest point is over 200 feet.

The section shown is continued throughout the full length of the dam until the spillway is reached. Here the masonry curves around to the right, parallel with the hillside, and extends for nearly a thousand feet up the valley, the total length of the spillway including the curve being an even thousand feet, and the total length of the dam and spillway together being 2,168 feet. As it is the intention to carry a carriage drive across the crest of the dam, an arch of steel or masonry (probably the latter) will be thrown across the spillway as shown in our illustration. At the junction of the spillway and dam is a gate-house; and on the down-stream side of the dam, in connection with this gate-house, a projecting column of masonry has been thrown out, within which is a stone stairway leading up to the crest of the dam. A clever use has been made of the break in the dam where the old earthen dam was to have commenced, by throwing out a column of masonry of the same design as that at the spillway, with an inside stairway leading to the crest of the dam. The architectural effect thus produced is harmonious and decidedly pleasing.

One of our photographic illustrations shows the method by which contractors are building the 300 feet of structure which has taken the place of the projected earth dam. Two steel working platforms have been erected, the foundations being placed right in the body of the masonry. At each corner of the platform is a steam derrick, the two platforms together thus providing eight derricks in addition to the large number which are erected outside the line of the dam. By this means the whole work is completely covered, and the material is handled to excellent advantage. As the masonry rises, the steelwork of the platforms is built into it and serves in a certain degree to tie it together. The rock, in masses which weigh many of them over five tons, is brought from granite quarries situated a short distance up the Croton valley. It is drawn alongside the dam in cars, from which it is picked up by the derricks and dropped into place. A new method of building the masonry has been adopted, which not only conduces to great speed of erection, but also provides a more solid monolithic mass, with less possibility of voids occurring in the body of it. The outside courses of masonry are first laid up, and transverse walls run across between these, thus forming pockets that may be from 12 to 20 feet square and from 3 to 5 feet in depth. A mass of cement is then poured into the pockets thus formed, through wrought-iron pipe chutes, that lead down from the cement mixers on the adjoining hillside. When the pocket is filled to the desired height with cement, the big rocks are picked up by the cranes and let drop from a considerable height into the liquid concrete and cement bed. The impact thus secured forces the cement with a crowding effect into all the interstices of the adjoining masonry. The swarm of Italian workmen are meanwhile throwing smaller rocks, that can be handled by hand, in around the bigger stones, and the speed with which the work progresses must be seen to be appreciated.

An important detail attending the completion of the dam is the reconstruction of the old aqueduct, which leads along the hillside over 30 feet below the high-water level of the new dam. It is necessary to strengthen the roof of the aqueduct, to enable it to withstand the water pressure resulting from the filling of the new dam, for the aqueduct will be covered with about 30 feet of water when the new dam is full. This is done by throwing over the aqueduct a thick concrete roof, which extends well down the sides and provides an absolute safeguard against crushing in of the structure.

The construction of the roads which will surround the Croton dam has been quite an extensive work in itself. It has necessitated the building of some very fine bridges, some of which we hope to illustrate in a future issue. The work of stripping the surface of the ground below the water line of the new dam has been pretty nearly completed, and it is now possible to look up the valley, and determine by the brush and timber line where this high-water line will extend. It is the hope of the Commission to commence to back up the water in the dam by the first of next year. Before that is done it will be necessary to close two tunnels through the masonry of the dam, one of which exists for the passage of work trains, and the other for the outflow of the Croton River. The work-train tunnel will first be blocked in, after which two 4-foot pipes provided with gates will be inserted in the tunnel through which the Croton River is now flowing. When everything is ready the gates in these two pipes will be shut down, and the work of filling the great reservoir will have fairly commenced. When we remember that the average daily consumption of water from the Croton watershed by New York city is nearly three hundred million gallons, and that the flow of the Croton River during a dry season may fall to between four and five hundred million gallons per day, it can be seen that it will be a long while before the water reaches the crest of the dam, if indeed it ever does so. Of course, the prevalence of heavy rain storms, or a thoroughly wet season, would expedite the filling of the dam.

Although it is hoped to close the dam by the beginning of 1905, it will not be for some months after that the whole work will be completed and everything put in its final shape.

Success of Governmental Enterprise in Italy Against the Spread of Malaria.

Italian scientists having proved that malaria is transmitted from infected districts by the mosquito, caused the Italian government to adopt measures of protection against its extension to government agents and officials required to reside in malarial districts.

In the "Nuovo Antologia" of Rome of recent date, is a comment on the remarkable decrease in the expenses of installation and maintenance of the means taken to diminish the causes of malaria in infected districts where customs officials are located. This reduction, however, does not impair the thoroughness with which the work is maintained.

The protection is purely mechanical, and could not have been more efficient or successful. The account goes on to say: "In the ninety localities thus protected for the first time in 1902 (the only year of which we have any complete data) there have been but one hundred and forty-two cases of the fever against six hundred and forty-two the previous year; the reduction, as we see, was nearly from five to one, and in some districts, as for example in those of Orbetello and of Terranovia in Sicily, where the cases of fever had been respectively twenty-nine and twenty-four in 1901, these had disappeared altogether when the protective measures were applied in 1902. In the twenty localities that had already been protected in 1901, the difference in the number of cases of malaria which came to light in 1900, when the defensive measures had not yet been adopted, and those which occurred in 1902 was still greater, when they dropped from two hundred and seven to twenty-five."

In the year 1902-3 the means of protection (small gauze nets, masks with veils, and gloves) were made applicable to one hundred and nineteen other localities, and this extension of the humanitarian means continues, and will continue to be applied to all the barracks and customs inspectors situated in the infected districts, to co-operate—as has just been said of the general directorate of customs—"to the supreme end of protecting against the ravages of this dread disease so many young and youthful existences."

But the most important results yet obtained have been from the anti-malarial measures adopted by the prison officials in charge of the prisoners condemned to spend their lives and energies in the salt works of Corneto, where the infection was so general and so grave indeed as to be declared invincible. Here among the confirmed criminals assigned to the labors of preparing and collecting the salt, the sufferers from malaria had amounted to three hundred and ninety-five in 1900; by 1903 these were reduced to a single one.

We desire to call the public attention to this, because it treats of works and facts that not only confer high distinction upon the Department of Finance, but also redounds indirectly to the honor and praise of the Italian scientists, to whom we are unmistakably indebted for the tireless researches and the grand discoveries that have made such wonderful achievements possible.

Peary and the North Pole.

Robert E. Peary has announced that he will again attempt to reach the North Pole in a specially constructed vessel, in which he will embark next summer. The presentation to Peary of the Paris Geographical Society's gold medal was the occasion of the announcement. M. Cordier, president of the Paris society, made the presentation speech. In responding, the explorer said:

"The contract for my new Arctic ship has been signed and her keel is being laid now. This means that the expedition upon which I have been putting my energies for the past two years is lifted out of the realm of uncertainty, and that if I am alive I shall start north again next summer in another attempt upon the North Pole.

"My vessel will, I believe, be the ablest ship that ever pointed her nose inside the Arctic or Antarctic circle. She will possess such shape as will enable her to rise to the pressure of the ice floes and escape destruction. She will possess such strength of construction as will permit her to stand this pressure without injury. She will possess such features of bow as will enable her to smash ice in her path, and will contain such engine power as will enable her to force her way through the ice. In maximum dimensions, viz., length over all, breadth of beam, and draft, etc., this ship will be of the size of the British Antarctic ship "Discovery"; in displacement she will be somewhat less; in power she will compare with our largest ocean-going tugs. She will have engines capable of developing 1,000 indicated horse-power continuously, and 1,500 horse-power for limited periods.

"My route north presents features very different from the route of a ship to the Antarctic regions; the voyage is short and the crux of the whole project is the successful negotiation of the comparatively short distance of ice-encumbered channels extending northward from Cape Sabine to the Polar basin.

"What I require, then, is not a sailing ship with weak auxiliary engines, a ship capable of remaining out for a number of years and covering long distances at slow speed, with moderate consumption of coal. My requirements are a powerful steamer, capable of forcing her way through this comparatively short distance and demanding only a minimum amount of sail power to enable her to creep home in case all her coal is burned—that is what I propose to build.

"My plan of campaign, in a very few words, is to force this ship to the north shores of Grant Land, taking on board at Whale Sound the pick and flower of the Esquimau tribe with whom I have worked and lived so long, to go into winter quarters on that shore, and to start with the earliest returning light on the sledge journey across the central polar pack, utilizing these Esquimaux, the people whose heritage is life and work in that very region, entirely for the rank and file of my party.

"Never before has it been in the power of a white man to command the utmost efforts and fullest resources of this little tribe of people, as I can do; and that fact will be of inestimable advantage to me."

The Current Supplement.

The St. Louis correspondent of the SCIENTIFIC AMERICAN opens the current SUPPLEMENT, No. 1499, with an admirably illustrated account of the Government Building and Post Office exhibit at the World's Fair. Historically, the exhibit is full of interest. It shows how the mails are handled and the various methods adopted in transporting mails in such remote regions as Alaska. Prof. F. B. Crocker and Mr. M. Arendt write instructively on electro-chemical industries. "Substances Liable to Decomposition by Light" is a subject discussed by F. A. Upsher Smith. Emile Guarini presents an account of a new system for the protection of trains by an audible signal in the train cab. The system is certainly ingenious, and has been tested with some success in Europe. Prof. A. Rateau, one of the great authorities on turbine engines, suggests methods of using steam turbines for current purposes. Of archæological interest is an article by Harlan I. Smith on shell heaps of the Lower Fraser River of British Columbia.

In a recent experimental investigation by Dr. T. Wulf, published in the Zeitschrift für physikalische Chemie, it is shown that the electromotive force at which hydrogen ions are liberated from solution, when determined galvanometrically, is quite independent of the pressure when this is varied between 0.01 and 800 atmospheres. On the other hand, the polarization of the hydrogen electrode increases with the pressure, and this increase is in quantitative agreement with Helmholtz's formula. The experiments show that the passage of a current through the solution is not necessarily accompanied by the liberation of the gas in the form of bubbles.

THE "LEBAUDY II."

BY EMILE GUARINI.

On the morning of the 28th of August, impelled by a heavy gust of wind, Lebaudy's airship "Le Jaune" broke away from its moorings and began its upward flight very much as did the captive balloon recently from Porte-Maillot, but with this more fortunate difference, that no one was in the basket at the time, nor did an explosion ensue as a consequence; except for a few unimportant injuries, everything went well.

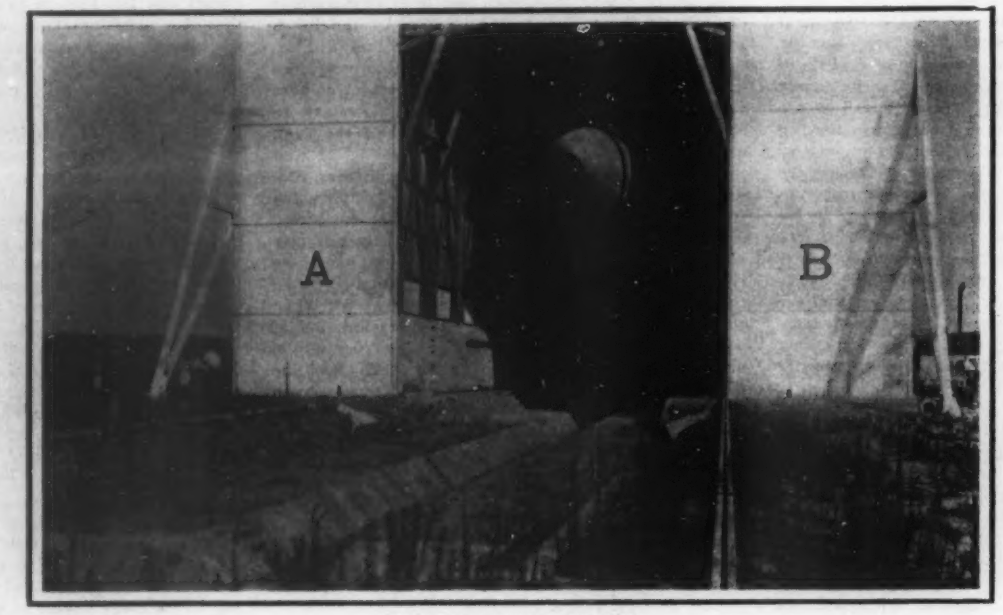
The accident happened while making the balloon fast to its retaining ropes. It rushed up rapidly to a height of 1,000 meters, but as the result of a lowering of the temperature it descended of itself, and touched ground in the forest of Fontaine-Labbé near Serquigny after a flight of more than 80 kilometers (50 miles).

By a miracle almost the gas bag was not torn at all; while the metallic framework suffered only slight injuries.

Mr. Julliot, the maker of the balloon, declared with satisfaction that this unforeseen escapade has established what the "Jaune" can do when left to itself, as well as permitting the opportunity to confirm the perfect functioning of the automatic valves, to which is due the circumstance, that, in spite of the elevation of the temperature, the balloon did not burst.

It is in condition to continue its ascensions—this one being the fourth or fifth since the flight of July 1 in five or six weeks—the repairs being limited to the replacing of several tubes that were bent. It has been decided that the aeronauts will continue their experiments in France. Both Mr. Paul and Mr. Pierre Lebaudy deem it of greater interest to spend the rest of the year making experiments in France than to waste their time making ascents at the St. Louis Exposition. The "Lebaudy II." is above all an airship for study, and is equipped accordingly. It is provided with a Gaumont camera that can be continuously operated, besides having some horizontal projections that allow of rigorously determining the variation of the velocity and direction attained, by causing the power, the direction, and the velocity of the balloon itself to vary.

It is proposed also to make use of the balloon, which will thus become an actinometer of precision, to determine the action of atmospheric agents. It will become a veritable floating observatory. Nocturnal voyages are in prospect during the absence of that grand disturber called the sun. With this end in view, the "Lebaudy II." carries a powerful searchlight, which will illuminate the surface of the earth most vividly, making it possible to distinguish the places over which it is passing. These experiments must infallibly lead to renewed study of spherical balloons, whether provided or not with balloonets, as well as to the further investigation of propelling devices. The essential characteristic of the "Lebaudy II." as well as of the "Lebaudy I." is stability. The catastrophe which happened last year at Chalais-Meudon and put an end to the career of the "Lebaudy I.," in the opinion of Col. Renard, cannot be attributed either to faulty construction or to mistaken manipulation of the pilot Juchmès.



The "Lebaudy II." in Its Shed.

It seems to him that this exceptional stability is due to the fact that Mr. Julliot, the constructor of the balloon, did not allow himself to be deterred by the objections raised by the expert mechanics, who found in their calculations that he must use propelling screws of very large diameter working at the end of a strengthened beam. On the contrary, Mr. Julliot created a particular type suitable to aerial locomotion, for in this instance he made use of two screws of moderate diameter, which he established at the greatest cross-section of his dirigible airship, one on the port and the other on the starboard side, each one actuated by a separate motor.

Consequently, even admitting it to be a logical proceeding to study the conditions affecting stability in a balloon during its flight, by forcing air, with rotary fans, into a tunnel containing paper models, no one was reasonably capable of applying to the "Lebaudy" the results of the calculations reached during experiments with other machines. Besides, the stability is obtained by means of a system of planes. Now the idea of making airships stable by means of aeroplanes is by no means new. It has been mentioned in patents on several occasions, but without exactitude, and it was only in the Lebaudy patent of May 8, 1903, that the means employed in the "Jaune" for making the airship stable were brought forward for the first time—means which have certainly contributed to the exceptional stability of this aerostat.

In this patent the Messrs. Lebaudy show the coexistence of two species of plane surfaces, the one a horizontal, to establish a horizontal or flat stability, and the other a perpendicular plane, to endow the airship with constancy in the vertical plane. Although both species of planes are mentioned together, the means of producing the horizontal stability are the ones upon which the greatest dependence is placed. As a matter of fact, the efficiency of these planes increases with the velocity of the ship. Several planes for attaining different positions have been fixed upon the long keel, which formed a sort of a feathered tail. The direction of these planes, and even their surfaces, may be changed, but not during flight; otherwise they would constitute merely a bundle of little rudders. Here is an example of the construction of these directing planes, destined to keep the ship upon an even keel. The make-up of the other planes in analogous. It must first be stated, however, that the basket is soldered to a steel cylinder, solidly braced and rendered non-breakable by interwoven steel wires, thus constituting a stiffening system of great strength. This cylindrical tube is of oval shape, having a diameter of 95 feet in one direction and 19.68 feet in the other. The directing plane, of which we shall now speak, is formed by a tube extending over a semi-oval, soldered upon the tube and made solid, in the same manner as the oval cylinder, by braces and steel wires. This plane is 95 feet long, with a height of 4.23 feet, affording a surface of 172.16 to 193.68 square feet. It is situated about 16.4 feet below the center of gravity of the balloon, which will permit us to estimate its efficiency. The prospective "Lebaudy," which will make ascensions next year, will have, however, both fixed and movable planes, adapted to both horizontal and vertical motion; moreover, the screw propellers will be pro-

Preparing for an Ascent.

Sliding the Airship Out of Its Shed.

Ready for a Flight Over the Meadows of Moisson.

THE "LEBAUDY II."

Philippine House. Native Cooking Dog Meat.

Dwelling of Ainus, the Aboriginal Race of Japan.

Wichita Summer and Winter Grass Houses.

Pawnee Earth Lodge to Right; Summer House to Left.

Arapaho Winter Tepee, with Brush Wind-Break; Summer House in Foreground.

Cocopa House, Old Mexico.

From photographs taken especially for the SCIENTIFIC AMERICAN.

Patagonians in Front of Native Hut of Pole Framing Covered with Hide.

Kickapoo Indian Bark House.

GROUP OF NATIVE DWELLINGS, ST. LOUIS EXPOSITION.—[See next page.]

vided with jointed wings. It must not be overlooked that the "Lebaudy II." is a trial ship, and that the pilot Juchmès must have at his disposal several means of procuring the requisite stability of his ship during flight, so that he may choose that which offers the greatest advantages.

The "Lebaudy II.," having no need of ballast, may without inconvenience make ascents of 6,500 feet, a circumstance that offers many considerable advantages. First of all, the pilot has more latitude in the choice of a more favorable current of air or in the avoidance of unfavorable currents. Again, from this height he can examine the surface beneath him, comprised within a circle having a radius of 74.5 miles—surely an inestimable advantage in time of war. Still another good quality possessed by the "Jaune" is that of preserving its shape without variation and not forming pockets. An airship which does not fulfill these conditions is a hundred times worse than a spherical balloon. The catastrophe attending the "Santos-Dumont II." furnishes a memorable proof of this. The danger begins at the moment when the apparatus which inflates the bag ceases to act, from any cause whatever. The precaution taken by Mr. Julliot, of placing two independent motors in the basket, is therefore a good one.

Presumably no accident will happen to both motors at the same instant; such a disaster is less to be feared, because both of the motors are under care of an engineer, who never loses sight of them while in operation.

NATIVE DWELLINGS AT THE ST. LOUIS EXPOSITION.

BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

In previous articles on the World's Fair at St. Louis, we have referred to the unique opportunities which are presented for a study of the various races of the earth, their habits and their modes of life. A most attractive and eminently instructive branch of the anthropological section is a group of reproductions, built to full size, of native dwellings, the greater part of which represent the homes of the various aboriginal tribes of North America. The exhibit encircles the large parade ground in front of the building of the United States Indian Industrial School, of which we shall have more to say in a later article. In every case the dwellings are built of the same material and in the same manner as were customary, or are to-day customary, among the tribes that they represent. In the case of several of the North American Indian tribes, it was difficult to find Indians who were familiar with the art, now extinct, of building these homes, and in almost every case it was necessary to seek out some very old Indian, who acted as master builder over the younger natives. The first, and in some respects the most striking structure, is the bark house of the Kickapoo Indians, which is about 12 feet in diameter by 6½ feet in height. It consists of a framework of willow poles, each frame being approximately semicircular in form, to which is fastened wide strips of overlapping white or red elm bark, the pieces of bark being tied to one another and to the framework by strips of the bark. There is a single low door, that is usually covered by a skin. In the center of the roof is a square opening that serves as a chimney, and is sometimes provided with a bark or canvas hood, which can be shifted with the wind.

Next follows the primitive dwelling of the Maricopa Indians of Arizona. The huts, which were generally built along the rivers, were constructed on a willow frame, the sides and roof being built of arrow weed. The Maricopas are gentle, and of kindly disposition. When the white man first discovered them, they were prosperous, having adapted themselves to the Aztec style of farming, and making use of the old Aztec ditches for irrigation. When the white people came, they found that the land was of good quality, suitable for irrigation. They went above the Indian reservation, taking out by means of ditches all the river supply, and leaving practically no water, under normal conditions, for the farms of the Reservation. As a consequence, these people soon found themselves to be objects of charity, depending upon Government rations; and many who were formerly prosperous had to leave their homes and scatter in search of work. Next to the Maricopa dwellings one sees two small, conical, earth-covered houses of the kind that were built by the Navahos. These consist of a framework of willow poles covered with grass sod. Compared with some of the other native homes, they are small and uncomfortable. The Navahos are still a more or less nomadic tribe.

In most cases the exhibit includes both the winter and summer homes of the tribes represented. Thus the winter tepee of the Cheyennes is shown side by side with their light bark-covered summer house. The same is true of the Arapaho exhibit, of which we present an illustration. It shows a typical tepee, or winter tent, consisting of framework of poles covered by canvas (originally, of course, the Indians used skins for this purpose) and surrounded by a brush stockade, which serves to break the force of the winds that sweep at times with great force across the prairie. In front of the tepee is the light summer house, consisting of a flat roof covered with grass and supported on four corner posts; the object in building the summer dwelling being to get as much ventilation as possible, while securing shelter from the direct rays of the sun.

The most imposing building of the whole group is a Pawnee earth lodge, 40 feet in diameter and 20 feet in height. This is an ordinary size; but at times these lodges would be built with a diameter as large as 65 feet. The framework of the building is very heavy, as it must needs be to carry the great weight of the earth and grass sod with which it is covered. A circle of eight 6-inch posts stands in the center of the lodge, the posts serving to support the main rafters. Arranged around the wall are a number of bunks, and entrance is had by a long vestibule or porch, the doorway of which is shown in our engraving. Adjoining the earth lodge is a summer house of light construction, but more pretentious appearance than that of the Arapaho. A picturesque group is that of the Wichita Indian dwellings, which comprise a winter grass house and two summer houses. The frame is of split willow, the rafters of lighter split willow, and the intersections are tied together by willow bark. The framework is roofed with rice grass. Of the two summer houses, it will be noticed that one is the customary flat roof carried on four posts, while the other is a larger and more pretentious structure, affording a considerable amount of shelter from the weather, but being left open near the ground to allow the wind to pass through. Another of our illustrations shows a typical dwelling of the kindly Cocopa Indians of old Mexico. It is a very primitive affair, built of willow poles and the tule rushes which grow in the water at the edge of the streams. On the top of the rude porch in front of the house are one or two native baskets, while on the table are spread out various samples of native bead work for sale.

One of the most curious and picturesque of the native homes is the dwelling of the Ainus, the aboriginal race of Japan. The hut has vertical walls and a rather high-pitched roof, the side walls and the roof being thatched with a native reed. Their dwelling is protected from the evil one by sacred prayer symbols, one of which is a head of a bear, which, by the way, is an object of worship. There is not a race among the many present at St. Louis that is attracting more intelligent interest than these remarkable people, who are ethnologically a puzzle even to the Japanese themselves.

The Patagonian "giants" as represented at the Fair are something of a surprise in the fact that their stature, judged from American standards, is not abnormally tall. Their dwelling, as shown in our illustration, is of a very primitive character, consisting of skins sewn together and supported upon poles and rafters in the manner indicated. We have so lately dealt with the Filipino that it is not necessary to say much about his bamboo house, as shown herewith. The particular Igorrote in front of the house is engaged in cooking a portion of the dog meat which forms one of their favorite and characteristic dishes.

The Making of a Welsbach Mantle Briefly Told.

The incandescent gas mantle was invented by Auer von Welsbach in 1885, and patented all over the world. The manufacture and use of mantles was first taken up in Austria, and has since found its way in all of the civilized countries where gas is introduced. At the present time it is estimated that no less than one hundred and fifty millions of mantles are manufactured annually. In the United States, although there are about forty millions manufactured annually, the industry is only partly developed. The public is gradually learning to use the mantle.

The mantle is made as follows: A "cone" or spool of No. 40 white cotton thread is knitted into a "stocking" or hose, about two inches in diameter. This stocking is thoroughly washed and dried. Then it is saturated with a solution of nitrate of thorium and one per cent of nitrate of cerium. The thorium is manufactured from a sand called monazite, which is found in Brazil and in the State of Carolina, and is rather expensive, being sold at $6.50 per pound.

One pound of nitrate of thorium yields from 300 to 350 mantles, depending on the quantity distilled. After the cone has been washed and dried it is either cut to proper size and impregnated with the thorium solution, or is first impregnated and then cut to the required lengths. The impregnated stockings after being cut and dried are sewed at one end with asbestos thread, so as to form a head provided with a loop, which serves to hold the mantle in process of manufacturing and when in use on the burner.

Then the impregnated stocking is hung on a wire by an asbestos loop, and heated in a gas flame of the Bunsen type. This is done in order to burn out the thread. The next process is called the shaping. The mantle now consists only of ashes of thorium (oxide of thorium) and is carefully held over a Bunsen flame, and gradually given the right shape, at the same time being hardened. As soon as the mantle is shaped and hardened it is practically completed; but in order to protect it from breakage it is "dipped" in a stiffening solution. There are many forms of "dip," but the one most used is made of soluble cotton (guncotton) dissolved in good alcohol and acetone. To this mixture castor oil and shellac are added. Before the mantle can be used on a burner this "dip" or coating must be burned off. The method employed in the manufacture will be described in detail in an early issue, and fully illustrated.

Automobile Notes.

Gen. Gallieni has lately organized an automobile service in Madagascar for transporting postal matter between Tananarive and Mahatsara. In spite of numerous difficulties which are due to the local conditions the experiment has succeeded very well. Capt. Gruss states that the automobiles have been running for seven months past with great regularity. At present there are six of the postal vans, but it is hoped to increase the number to ten, to take care of the large amount of mail matter which passes over this route. In seven months the automobiles have made a total distance of 30,000 miles, carrying 106 tons of mail matter. The total expense has been $18,000. The present system was supposed to be impossible by many, but it is now proved to be a success and will no doubt be greatly extended in the future and other lines will be run on the same plan.

The French Minister of War has opened a contest of automobile wagons for use in the army. They are to be heavy hauling cars or vans for transporting provisions and different kinds of material. The first three vehicles which come out best in the contest will be purchased by the state. The price of each is not to exceed $1,700. The trials will be made in the neighborhood of Paris and will comprise eight days of different kinds of tests. Only cars of French make are allowed to enter the contest. The total weight of the car when loaded is not to exceed 3.7 tons, of which 1.8 tons represents the net load. The motor is to give 12 horsepower at the minimum, at a limited speed of 1,000 revolutions per minute. The jury will pass upon the following points, giving each a certain co-efficient for a total of 100: Power of motor and design, simplicity, etc., 13; cooling, 5; consumption of combustible, etc., 15; operation of different organs, 15; wheels and tires, 15; brakes, 10; good handling of the car, 5; starting and grades, 8; proportion of load to total weight, 5; speed, 3; cost, 6.

To find out how automobiles can be best utilized for military service, an interesting series of maneuvers is now being held in Italy. The idea is to call upon automobiles in time of need and to mobilize them just as is done in many countries for horses belonging to private individuals. The present tests have been organized by the Minister of War in connection with the Milan Automobile Club. The tests last for a week and were commenced on the 30th of August. More than fifty chauffeurs entered the maneuvers, which were held at Brescia. They started early in the morning. At the last moment each chauffeur received a sealed envelope giving him a certain route to follow, and he was obliged to reach a certain point, which was often at a great distance off or at a high altitude in the mountains. The chauffeurs were required to return to their posts in less than 24 hours. Some of them were ordered to proceed at full speed to the Austrian frontier. The result was very satisfactory. All the cars except one returned to Brescia before midnight. The remaining car had been damaged by running into a telegraph pole. The military authorities are highly pleased with the performance of the cars and the skill of the chauffeurs. These experiments will no doubt be followed by others.

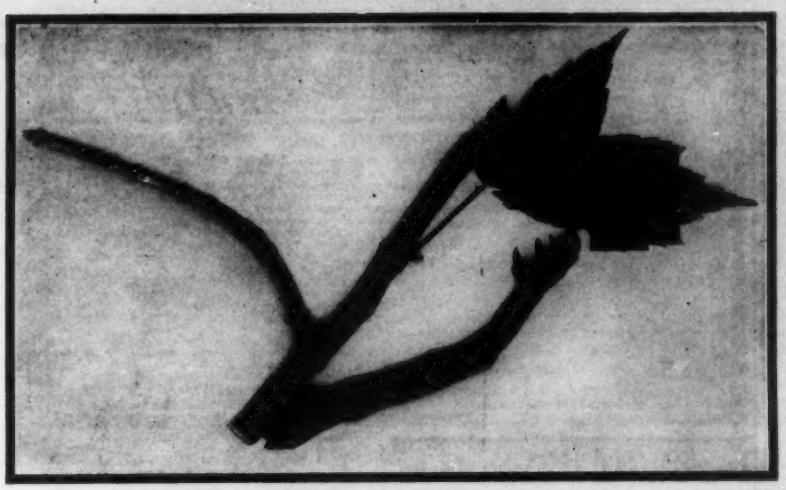
The autumn military maneuvers in France have brought out an unusual number of automobiles. The chauffeurs who figure in the exercises are to pilot the officers of the Etat-Major in their cars. The maneuvers of the automobile corps commenced by a grand review which was passed before Commandant Gentry. This well-known officer has charge of the army automobile matters and is himself an experienced chauffeur. Each *quartier general* will have two high-speed cars and four light cars at his disposal. To each corps of the army is allotted one high-speed car and one light automobile. In the maneuvers are many well-known chauffeurs, and nearly all the leading makes of car are represented. The cars which are to follow the maneuvers of the East will start from Paris and arrive at Dijon on the 6th of September; those of the Northwest maneuvers reach Verneuil on the 4th. Gen. Pendezec, the chief of the Etat-Major, who is in charge of the exercises, will be piloted by Marechal Cailiois on a Georges Richard car. The military chauffeurs will receive an indemnity during the whole of their voyage which has been fixed by the Minister of War at $0.008 per horsepower-mile, and $0.027 per horse-power per day. To this is added a fixed indemnity of $0.50 for soldiers of the troops and $0.60 for the inferior officers.

STRIKING EXAMPLES OF INSECT MIMICRY.

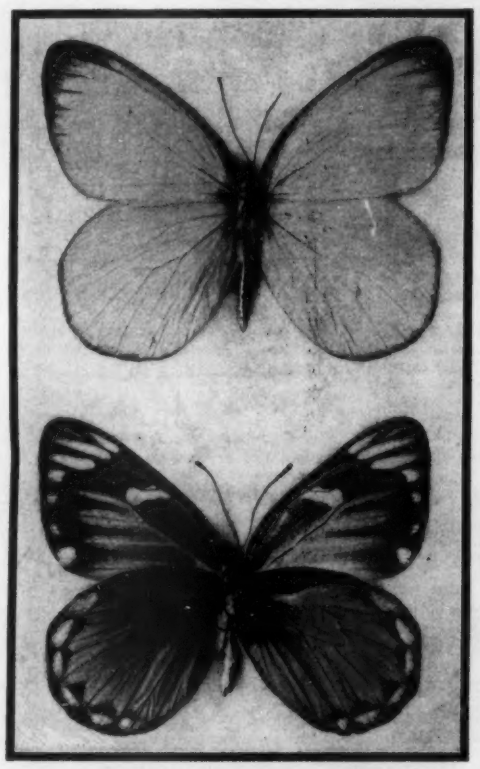
BY O. FULDA.

Natural history, including insect study, entomology, is taken up in the public schools, and in walking in the country we often come across our American boys with butterfly nets.

One of the most interesting observations that can be made in the study of insects is the manner in which the animals attempt to protect themselves when pursued by their enemies. There is, for example, among the moths the genus *Catocalac*. As a rule, their hind wings have a beautiful, bright coloring, but they can so conceal these under the wing sheath, which is usually gray or brown, that it takes a sharp eye to discover the animals when at rest on the trunk of a tree. A striking fact is that the dark-colored varieties seek concealment on trees with dark bark as, for instance, the oak, while the lighter-colored varieties rest on trees such as the birch or maple. But the best example of mimicry in the insect world is that which is given us by the leaf imitators, which are brightly colored on top, but when their wings are folded, exactly represent a leaf. One of the most striking examples of this is the *Kallima inachis*, found in India.



A Caterpillar (Bunomos magnarius) Simulating a Twig.



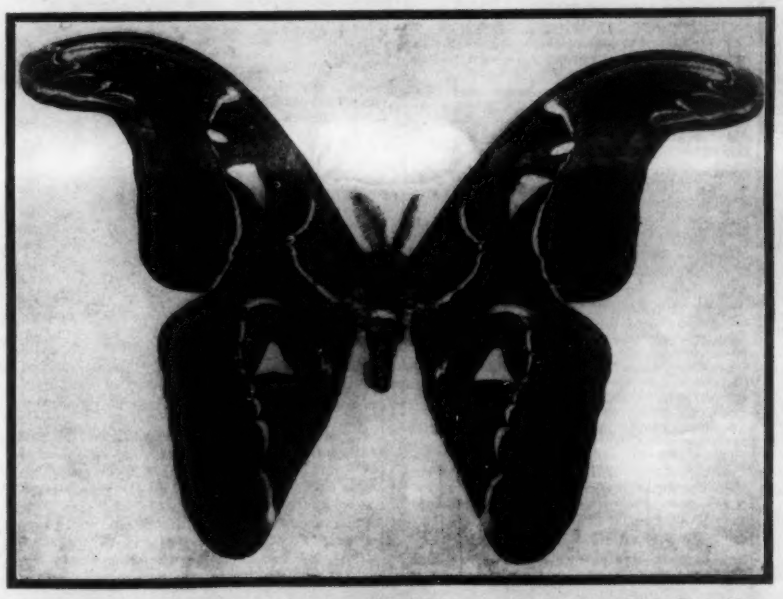
Upper and Under Sides of Delias des Combesi, India, Showing the Protective Marking.

Moths are able to deceive the eye in more than one way. There is one species that, when sitting on the bark of a tree, exactly imitates the lichen. Others, when resting on the upper side of a leaf, present the appearance of bird droppings.

Of other insects the "walking stick" can make itself particularly difficult to see, in that it appears like a green or a dry twig according to its color. The caterpillars also of many butterflies and moths imitate their environment. One of our illustrations shows a caterpillar of the *Geometridæ*, *Eunomos magnarius*, which always assumes such a position that it is frequently taken for a twig of the plant on which it feeds.

Among the butterflies there are kinds that seek, through their appearance, to frighten their pursuers. The South American *Caligo* species are on the upper side a beautiful blue or gray and blue, while the under side has the color and marking of an owl's head with large, open eyes. It is easily conceived that the animal is able to frighten, when, spreading its wings, it suddenly simulates the appearance of an owl.

The giant Indian moth, *Attacus atlas*, may also be here mentioned. This animal can assume such a position that it represents the head of a certain Indian snake. Its wings when completely spread measure eight inches from tip to tip.



Attacus atlas, India. Spread of Wings, Eight Inches. Protectively Marked to Resemble a Certain Snake's Head.

STRIKING EXAMPLES OF INSECT MIMICRY.

Corks and Their Supposed Induced Radio-Active Effect on Photographic Plates.

BY MYRON METZENBAUM, M.D.

While investigating the action of radium and radio-active substances on photographic plates, I observed that whenever radium, uranium, thorium, or zirconium compounds were placed on a plate of plain glass which was elevated by means of corks above a photographic plate, whenever the corks were directly in contact with the film of the photographic plate, not only did these radio-active substances affect the photographic plate, but an image of the structure of the corks was also to be seen on the plate.

This image of the corks could be noted on the plate after twenty-four hours, and could only be seen while developing the plate, but would wash out almost entirely in the fixing solution.

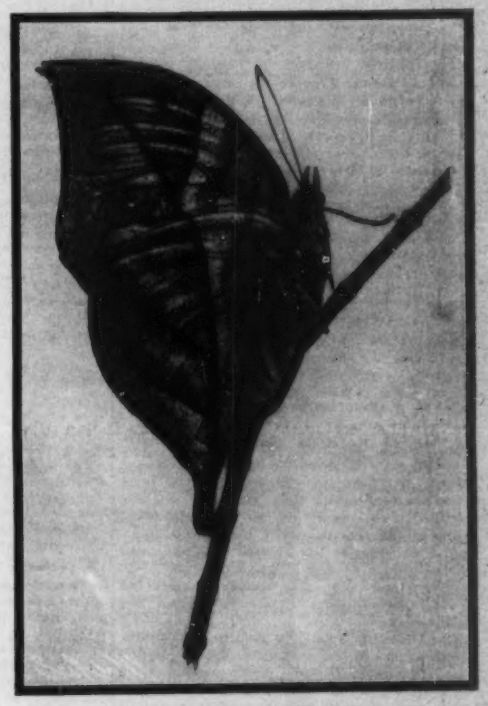
If the time allowed was at least four days, the action on the plate was sufficiently deep, so the image of the corks remained after the fixing, but it required at least twelve to twenty days before the plate was acted on sufficiently so a good print could be made from the negative.

This observation of the action of corks on photographic plates was naturally interpreted as due to induced radio-activity caused from the radio-active substances on the suspended plate of glass, until the time when I made the observation which I reported in the SCIENTIFIC AMERICAN of May 14, 1904, on "Induced Radio-activity and Aluminium."

In this article I showed that when radium is contained in hermetically-sealed tubes, and these tubes placed in various solutions and various powders for as long as twenty-one days, after this time neither the solutions nor the powders show the slightest effect on photographic plates; but when the solutions or powders were placed in aluminium boxes, and these boxes placed in direct contact with a film of a photographic plate, these boxes produced their image at the points of contact. I was able to show further that all sorts of aluminium articles, when placed only in direct contact with the film of the plate, gave an image, and that this action is one not due to radio-activity, but is either a chemical or electrical action between metallic aluminium and the albumenate of silver of the plate, or possibly due to pressure alone.

I therefore took new corks, and placed them in direct contact with the films of photographic plates and kept them out of all possible influences from radio-active substances, and then I noted that the new corks produced their image on the photographic plates just as before.

That this action is one not due to radio-activity may be inferred from the facts that when corks are separated from the film on the photographic plate by a piece of very thin paper, or placed on the reverse side of the plate for as long a time as forty days, the plate is not affected in the least, nor do corks have any effect on the electroscope.



The Indian Leaf Butterfly (Kallima inachis) which Mimics a Leaf Even to the Veining.

This action may possibly be explained as a chemical one between the residue of chemicals remaining in the corks after their bleaching and the film of the photographic plate, or possibly it may be pressure alone.

In either case this action depends on an intimate contact existing between the corks and the film of the plate, which means that the corks affect the plate only at the points of contact, for it is only the grain of the cork which is seen, causing the picture to seem as though it were a direct photograph.

The construction of a large terminal railway station with every facility for loading and discharging vessels, in basins specially to be constructed, has been decided upon at New Orleans. The situation of this station will be at Chalmette, to the east of the city, and a few miles lower down the Mississippi River. A number of engineers and their assistants are at present engaged taking soundings to a depth of 60 feet, and the ground destined for the works is being planned out. The company is working with San Francisco capital and will construct several basins 1,500 feet long by 250 feet wide, with a maximum depth of 50 feet.

RECENTLY PATENTED INVENTIONS.

Apparatus for Special Purposes.

PROCESS OF TREATING FLOUR.—J. M. WILLIAMS, Guthrie, Oklahoma Ter. In this patent the invention is in the nature of a process for whitening, aging, disinfecting, increasing the absorption of, and otherwise improving flour. It consists in subjecting the flour while in a state of agitation to the gases formed by the electrolysis of water or other liquids or compounds capable of generating oxygen.

Electrical Devices.

COMPRESSED-AIR SUPPLY FOR ELECTRIC VEHICLES.—R. LEB. OWEN and R. O. LE BARON, Pontiac, Mich. The invention relates to fluid-pressure brakes used on electric street cars and other vehicles; and its object is to provide a device for automatically supplying the compressed air required for working the fluid-pressure brakes, the device being actuated during the time the electric power is shut off in stopping the vehicle, thus utilizing the power ordinarily wasted.

Of Interest to Farmers.

INCUBATOR-BROODER.—C. H. SPERLE, Boundbrook, N. J. In this case the objects are to secure as nearly as possible the actual conditions obtaining in the operation of hatching eggs naturally. Mr. Sperle has discovered that the hatching-bird in addition to heating, rolling, and cooling the eggs also clutches them, while the air circulates around them without drafts, an operation not performed by any incubator heretofore known. A further object is to protect the young birds the first sixty days of their lives.

HAND-PLOW PROPELLER.—L. W. AVANT, Atascosa, Texas. One of the chief objects of this inventor is to enable the point at which the propelling force is exerted to be shifted vertically in order that the plow attachment may be adjusted to accommodate operators or plowmen of different heights; secondly, the attachment is so constructed that the force applied by the operator may be varied in its relation to the plow as conditions require; thirdly, the invention includes means for applying the attachment to the plow-handles, which are separated more or less from each other.

Of General Interest.

ARTIFICIAL TOOTH.—F. L. PRIEST, Dallas, Texas. In this patent the purpose of the invention is the provision of a solid or practically solid surface upon the back face of teeth in order to hold the faces firmly to a gold bridge or to a plate at all points, especially at the tips of the teeth.

REST DEVICE.—R. W. SCHROEDER, Bloomington, Ill. The aim in this instance is to provide a rest device more especially designed for use on the backs of chairs, school-desks, couches, and like pieces of furniture and arranged to properly support the back and sides of the person occupying the chair, to avoid undue fatigue and allow natural respiration, and to prevent deformities of the chest and shoulders.

CONDENSER FOR VACUUM-PANS.—J. F. UTZILLA, Jersey City, N. J. This invention has reference particularly to improvements in condensers used in connection with sugar-machines, an object being to provide a simple means for drawing gases from the condenser and dispensing with the vacuum-pump usually employed.

FLY-CATCHER.—J. SCHNELL, Macon, Ga. In this instance the invention is an improvement in that class of fly-catchers in which a continuous cord or strip of fibrous material is drawn through a body of tacky liquid and is subsequently cut off in suitable lengths for use in various localities.

CORNER-IRON FOR SIDING-JOINTS.—J. SIMPSON, Veedersburg, Ind. The purpose of the improvement is to provide corner irons or plates for the siding-joints of frame buildings, which corner-irons will render the joints impervious to water at the corners of the house, particularly such houses as are sided with shingles or clapboards.

Machines and Mechanical Devices.

MOTOR-CONTROLLED FAN.—C. S. WARNOCK, Americus, Ga. Mr. Warnock's invention relates to improvements in motor-actuated fans, especially fans operated by a spring-actuated motor. The purpose is to provide a device wherein the fan-blades or fly-brushes will operate with vibratory motion, enabling the device to be placed upon a table or support quite close to a person, without inconveniencing him. Means hold the fan or brush carrying arms in operating connection with a rocking support, together with means for imparting a cushioned vibratory motion to the racking support from a shaft, and also provide ready lateral and vertical adjustment for the fan-carrying arms. The claim is that the inventor's working model has proved entirely successful in operation.

Railways and Their Accessories.

VALVE.—W. T. HARRISON, Savannah, Ga. In this case the invention refers to improvements in valves for controlling the outflow of water from railroad-tanks, an object being to provide a valve so constructed that it may be readily removed for repairs without first running the water out of the tank, and, further, to provide a simple means for preventing the rattling or jumping of the valve.

CABLE-TRACTION SYSTEM.—G. W. SANDERS, Gadsden, Ala. In this patent the invention has reference to cable-traction systems, and has for its principal object the provision of an effective means for operating cars in either direction along a track. Mr. Sanders' system is very simple in construction and operation and subjects the cable to but slight wear.

RAILWAY-SWITCH.—M. BARNES, Syracuse, N. Y. In this case the invention relates to improvements in switches, particularly for use on street-railways, an object being to provide a simple switch that can be moved by a motorman without stopping the car to direct the car in any one of three directions.

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If it is a paper tube we can supply it. Textile Tube Company, Fall River, Mass.

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WANTED.—Addresses of importers and consumers of bamboo. D. F. Mitchell, Jacksonville, Fla.

Inquiry No. 6008.—For manufacturers of slot machine scales.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 6009.—For parties engaged in malleable casting work, brass work, etc.

American inventions negotiated in Europe. Wenzel & Hamburger, Equitable Building, Berlin, Germany.

Inquiry No. 6010.—For manufacturers of carpenters' tools.

Agents wanted to sell the Ryede puzzle. Sample by mail for 10c. Ryede Specialty Works, Rochester, N. Y.

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For Sale or on Royalty.—Three United States and Canadian patents on heating stoves and furnaces; or would like to incorporate. F. G. Pioch, Provo, Utah.

Inquiry No. 6014.—For manufacturers of machinery for sawing and quarrying sand stone.

NEW INVENTION.—Receipt for shoe polish, the best ever invented. For sale by chemist. Address Chemist, Box 773, New York.

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Inquiry No. 6017.—For manufacturers of life preservers for use on steamers.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc., Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 6018.—For makers of stills.

WANTED.—Back numbers: Automobile, October, 1900; Motor Vehicle Review, 1902; Motor Age, 1900; Motor Age, 1901. Mrs. C. F. MacDermot, Hotel Touraine, Boston, Mass.

Inquiry No. 6019.—For manufacture of aerated water.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 6020.—For a machine for printing on toothbrush handles.

FOR SALE.—Patent on rotary engine, explosive. Patent No. 759,953. The only rotary explosive engine that confines the gasoline in the explosion chamber till it has great force before it strikes the piston. D. V. Bagwell, 4340 Parin Street, St. Louis, Mo.

Inquiry No. 6021.—For manufacturers of bottle corks.

D. A. Beaton, Practical Lead Burner, P. O. Box 334 Woburn, Mass. Fifteen years' experience.

Inquiry No. 6022.—For dealers in stamped and tinted sofa pillow covers.

Inquiry No. 6023.—For importers of tea and coffee.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(9461) G. W. T. says: Seeing that your publication answers almost anything in the scientific line, I would be pleased to know if you can tell me of some substance that a magnet will not draw through. A. Magnetic attraction takes place through all excepting magnetic substance. Practically, iron is the only available magnetic screen. If a magnetic needle is inclosed in iron, exterior magnetism will affect it but little. The iron should be rather thick—at least a quarter of an inch. The reason for the screening action of iron is that magnetic lines of force pass through iron more easily than through other materials. When iron lies in their path they take to it, and do not pass through the adjacent air. A needle inclosed in iron is thus screened from magnetism.

(9462) K. A. E. asks: Will you kindly answer me in the Notes and Queries of the SCIENTIFIC AMERICAN the following question: How is nickel-plating to be made? A. For plating with nickel, the double sulphate of nickel and ammonia is almost universally used. The salt is dissolved by boiling, taking 12 to 14 ounces to 1 gallon of water. The density of the electrolyte should be 6.5 deg. to 7 deg. Baumé. Cast anodes are preferred. These should be large enough to reach to the bottom of the work, and have a surface larger than the work to be plated. The voltage may be from 3.5 to 6 volts, while the current should be from 1 to 2 amperes for every 37.5 square inches to be plated. For full instructions we would refer you to Watts' "Electro-Plating," which we can furnish for $4.50, or to Langbein's "Electro-Deposition of Metals," price, $4. Van Horne's "Modern Electroplating," price $1, is a good, though small, book, which may be a sufficient guide.

(9463) A. E. F. says: 1. How can I determine when the condenser of an induction coil is of proper size? What is the effect of one too large? A. An induction coil gives its greatest length and intensity of spark only when the condenser is of the proper size. The spark is diminished if the condenser is either too large or too small. 2. I have a small spark coil of the following dimensions: Length inside of end pieces, 3 inches; diameter of core, 9-16 inch; primary winding, two layers No. 18; secondary winding, 3 ounces No. 36 cotton-covered wire; diameter to outside of secondary winding, 1 11-16 inches. I have been able to obtain a ½-inch spark with this coil, and would like to know how to proceed to construct one of say twice the spark length of this one. My reason for asking this is that I seem to have acquired, with a small amount of secondary wire, the results which are obtained with ¾ of a pound of No. 36 silk-covered wire according to the usual directions for making such coils, but I do not know how to proportion the dimensions for a larger coil on the same lines in order to obtain the best results. A. The proportioning of coils is the result of experience. Of course, there are formulas for expressing the data of construction, but we do not think the ordinary mechanic employs them. To make a coil to give a spark twice as long as another coil, you will not be required to make the dimensions twice as great, but something less than this. All dimensions should be increased. A set of coils from the same shop will usually present a symmetrical increase of power. 3. Should I increase the length, the diameter of the core, use a larger size wire for the primary and increase the diameter of the secondary winding, and in what proportions? Also, if this admits of a direct answer, what is a practical maximum diameter of an induction coil, compared to its length? A. Different manufacturers differ in designing coils, and it would be difficult, if not impossible, to reduce the ratio of length to diameter. 4. If the outside end of the secondary wire is prevented from coming near any part of the primary circuit, is there any tendency to break down the insulation between the primary and secondary windings? If so, why? A. There is a tendency to break down the insulation of the secondary at all points, the greatest at points most widely separated. The reason for this is that the electromotive force rises in the secondary from the negative to the positive end proportionately to the number of turns of wire.

NEW BOOKS, ETC.

ELECTRICITY AND MATTER. By J. J. Thomson, D.Sc., LL.D., Ph.D., F.R.S. New York: Charles Scribner's Sons, 1904. 8vo.; pp. 162. Price, $1.25.

This book contains six lectures given by Prof. Thomson in May of last year, at Yale University. In them he discussed the bearing of the recent advances made in electrical science on our views of the constitution of matter and the nature of electricity. The relation between matter and electricity, which has been a characteristic feature of recent electrical researches, such as the study and discovery of Roentgen rays and radium, is here very thoroughly discussed. The book contains chapters on the "Representation of the Electric Field by Lines of Force"; "Electrical and Bound Mass"; "Effects Due to the Acceleration of Faraday Tubes"; the "Atomic Structure of Electricity"; the "Constitution of the Atom"; and "Radio-activity and Radio-active Substances."

ATLANTE DI MACCHINE E CALDAIE CON TESTO E NOTE DI TECNOLOGIA. Per Salvatore Dinaro. Milan: Ulrico Hoepli, 1903. 16mo.; pp. 80.

This is a useful handbook on steam boilers, steam engines, gages, and various kinds of steam machinery. It is abundantly illustrated with 112 full-page diagrams.

RICETTARIO INDUSTRIALE. By Ing. I. Ghersi. Milan: Ulrico Hoepli, 1904. 16mo.; pp. 703.

This is a book of valuable receipts for all trades, arts, and industries. It is arranged in alphabetical order, and, besides the receipts, there are a number of physical and chemical tables of value.

DIE WETTERKRÄFTE DER STRAHLENDEN PLANETENATMOSPHÄREN. Von C. Marti, Sekundar-Lehrer in Nidau, Schweiz. Nidau: Buchdruckerei E. Weber, 1904. Pp. 40.

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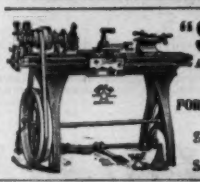

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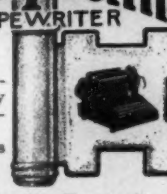

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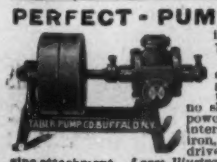

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GRAM 7

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dential. He said that Mr. Root was expected back in the city to-day and that he [illegible] to see him. If Mr. Root, he said, informed [illegible] that he had no objection to the publication of the letter, it would be given out.

Instead of convincing Gov. Odell and the other Republican leaders that Mr. Root could not be persuaded under any circumstances to accept the nomination for Governor, the publication of the letter was to create the impression that a united demand from his party would induce Mr. Root reconsider to the call of duty. It is understood that at their interview to-day Gov. Odell will leave definitely [illegible] Mr. Root whether he would decline a unanimous nomination if it were tendered him. If Mr. Root merely stands upon the declaration of his letter that he does not want the nomination, those leaders who believe that Mr. Root is the strongest candidate whom the Republicans could name will proceed to put fresh information into his hands, and the strongest reason to be that it would cramp all before.

When Gov. Odell was told what the conference had accomplished he said: "We discussed propositions and reached conclusions." As to the nature of either the propositions or the conclusions the Governor was reticent, but he admitted that they had to do with the management of the campaign in the State.

While it was the consensus of opinion after Mr. Root's letter had been read, that no effort would be induced to take the nomination under any circumstances, nevertheless the probability of his positive and final declination was discussed, and the names of other candidates whose claims would have to be considered in the event of Mr. Root's unalterable refusal were taken up. Among the available candidates whose merits were discussed were Lieut. Gov. Higgins, ex-Lieut. Gov. Woodruff, Collector Stranahan, Speaker Nixon, Senator George H. Raiby, and ex-Mayor Schieren of Brooklyn. Mention was also made of Gen. Aaron S. McCook.

ST. LUKE'S HEAD EXPLAINS

Says Drs. Taylor and Kellogg Did Not Break Glass

Superintendent George F. Cleeve of St. Luke's Hospital made a statement yesterday with reference to the arrest of Drs. Julius Taylor and Henry Kellogg, members of the house staff of that institution. He said:

"Drs. Taylor and Kellogg were country tested the hospital via One Hundred and Tenth Street from Riverside Drive, when, at One Hundred and Tenth Street and Amsterdam Avenue, they stopped to purchase patents. In crossing to the pavement stand they passed through the midst of eight or ten young fellows who were playing.

"Shortly after they had passed through the midst of the boys a window was broken in the house on the corner of One Hundred and Tenth Street and Amsterdam Avenue. The boys who were playing ball ran away, and Drs. Taylor and Kellogg were arrested by Policeman Hogan, who had seen the boys playing ball and who had seen the window broken. He thought that the two physicians were the guilty parties, and he arrested them. They were taken to the West One Hundred and Thirtieth Street police station, where they were locked up. Dr. Taylor sent for me, and I went to the station house and bailed them out. They were then taken to the Harlem Police Court, where they were discharged. Dr. Taylor and Dr. Kellogg had nothing to do with breaking the window. They were arrested by mistake."

ARREST 23 SPECIAL [illegible]

Omaha Sheriff and [illegible] Take Full Charge of Stockyards

OMAHA, July [illegible] Sheriff Power to-day swore in [illegible] and went to South Omaha, where he took charge of the stockyards strike situation.

The sheriff later arrested as vagrants thirty-two men brought here from Colorado to act as special officers. They told the police they did not want to return to Colorado.

The packers have prepared affidavits declaring the inability of the local authorities to protect life and property, and ask that the militia be called out. To-day, at the instance of the packers, warrants for the arrest of [illegible] strikers were sworn out, charging violence.

Another lot of warrants, issued at the instance of the strikers, bear the names of Robert C. Rowe of Armour's, Michael B. Shurley of Cudahy's, L. B. Patterson of Swift's, and Charles H. Urquhart of the Omaha Packing Company. They are charged with having imported men into the State to do police duty.

Constantyn J. Smyth, the strikers' attorney, said:

"The packers had forty members of a Colorado [illegible]

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